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ABSTRACT

The basic objective of this research program was to develop and to test an accountability model of the educational process. In cooperation with the Pittsburgh School District, a major effort was devoted toward the development of a data base, the construction of appropriate models and the conduct of analyses of the data. Some analysis was accomplished and one paper, "Operational Accountability" (ED 076 666) was written based on these preliminary results. It was decided to use data from the Equality of Educational Opportunity Survey (the Coleman Report) so that models might be developed and tested while developing local sources of data. Three papers have been written based upon the Coleman data: "A Simultaneous Equations Model of the Educational Process" (TM 004 650), "Education from an Anthropological Perspective: An Empirical Investigation of Structural Differences among Blacks and Whites" (TM 004 651), and "A Simultaneous Equations Model of the Education Process: The Coleman Data Revisited with an Emphasis upon Achievement" (ED 097 404). All of these papers share a common basic idea. The educational process has several outputs which include achievement, efficacy, motivation, and expectations. The notion is that all these must be considered endogenous variables sd that the educational process can only be modeled through the methodology of simultaneous equations. (RC)

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Final Report

TOWARDS AN ACCOUNTABILITY MODEL OF THE EDUCATIONAL PROCESS / Final Report

a project conducted by

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Pittsburgh, Pennsylvania

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Final Report

TOWARDS AN ACCOUNTABILITY MODEL OF THE EDUCATIONAL PROCESS

Introduction:

The basic objective of this research program was to develop and to test an accountability model of the educational process. Ideally, we would have liked to have had a model which had been developed, tested, and implemented by the time that the grant was supposed to terminate. Measured against this ideal, one cannot say that our performance has matched our ambitions and our dreams. However, a great deal of work has been accomplished and we feel that we have learned a great deal. In fact, we now believe that accountability models can be made operational and fully implemented although we have not had, and do not have, the resources to do so at the present time. In addition, it is only fair to say that the problem is much more difficult than we originally realized.

Basically, this grant covered two types of activities. First, in cooperation with the Pittsburgh School District, we devoted a major effort toward the development of a data base, the construction of appropriate models, the conduct of analyses of the data, and we hoped to have these findings implemented. We have not yet discussed implementation with the officials of the district because the analysis is not yet completed. In short, the construction of the data base, which absorbed most of our energies, turned out to be such a monumental task, and a task only partially under the control of our research team, that this effort itself was not completed until about the time that the project should have been over. This is not to say that no analysis was accomplished. Quite to the contrary, much analysis was accomplished and one paper, "Operational Accountability" was written based upon these preliminary results and this paper is included with this report. However, the analysis is still going on and should go on for some time since we believe that we have developed an excellent data base. If the findings warrant it, and if the districts are serious in their expressed desires to make accountability operational, we may seek additional funds to implement our findings and our methodologies.

Given the above, especially the difficulty in the acquisition of our data base from the Pittsburgh Schools, we looked around for another source of data so that models might be developed and tested while we were trying to develop our local sources of data. We decided that the data from the Equality of Educational Opportunity Survey (The Coleman data.) might be utilized for this purpose. We secured the twelfth grade tapes and, since this move enlarged the project beyond the scale which we had originally envisioned, we also secured some additional resources and have also invested a substantial amount of our own internal research support into this enlarged project. Three papers have presently been written based upon the Coleman data. These are titled, "A Simultaneous Equations Model of the Educational Process", "Education From An Anthropological Perspective: An Empirical Investigation of Structural Differences Among Blacks and Whites", and "A Simultaneous Equations Model of the Educational Process: The Coleman Data Revisited With An Emphasis Upon Achievement". A copy of each of these papers is enclosed.

It is appropriate to discuss these activities separately. We begin with a summary of the work directly associated with the Pittsburgh Schools.

The Pittsburgh Schools Portion of the Project:

As was indicated above, this portion of the project absorbed most of the original resources which were provided by the grant. It was also an extremely frustrating activity. Data acquisition from an on-going school system is extremely difficult even when, as was our case, an Assistant Superintendent is extremely interested in the project. (He just became the Superintendent.) Accordingly, in the discussion below we will first discuss the data which we have finally been able to accumulate and which we are now in the process of analyzing. Since we were interested in determing whether this frustrating activity would eventually be worthwhile, we conducted an analysis utilizing a part of the data and this work became the basis for the enclosed paper entitled, "Operational Accountability". A summary of that paper is provided in this text after the basic data is described.

Description of the Pittsburgh Data:

Our data collection procedures were guided by our ultimate research objective of identifying a variable which could be used as an indicator of the output of the educational process and partitioning the variance of the output variable into components associated with the home environment and personal characteristics of the children, the social locational characteristics of the individual schools, the characteristics of the administrative and teaching staffs of the schools, and the particular characteristics of the childrens' teachers. Furthermore, we were intent on creating a working data file composed of data at an extremely fine level of aggregation. Since we were interested in examining the effects of "contextual" variables such as neighborhoods and school environment we were cautious not to define a level of aggregation which would lead to an averaging out of such effects. This is a particularly severe problem with data, such as the census, which are collected on the basis of arbitrarilly defined grids. Initially, three files were constructed containing data on: I) Individual students; II) individual administrative and teaching staffs; and III) demographic and socioeconomic characteristics of the city. These are discussed in detail below.

I) Student File

Through the cooperation of the Pittsburgh public schools research staff we had the school system's computer department create two tapes detailing specified characteristics for students. The first tape contained records for 8,823 students who were in the 5th, 6th and 7th grades in 1970, took a battery of metropolitan area-wide achievement tests (MATS) in that year and took a similar battery of tests at the end of the following year.

The testing schedule for these two batteries of tests had been May, 1970, and April, 1971. Thus, we had change scores with which we would estimate the impact of one year's exposure to the educational process. The changes in achievement score -- the two tests thus became our dependent measure of the output of the school system.

The data recorded on this tape fall into three categories: 1) identification of student and school; 2) personal characteristics of student and residence location; and 3) test results for 1970 and 1971.

Specific items included under 1): the student's name, school system identification number, home rooms and schools in 1970 and 1971, and school area codes (the Pittsburgh Public Schools are organized into three areas which are each under a supervisor).

Under 2), data included the following: the student's sex, race, age (in years and months), grades in 1970 and 1971, names and residence by street address and zip code of parents or guardians, and participation in special programs.

For 3) data included the following: IQ scores on the Otis-Lenon test (taken in 2nd, 5th and 8th grades) and scores on the following MATs (in 1970) word knowledge, reading, spelling, language study skills, arithmetic computation, arithmetic problem solving, social studies, social studies skills and science. MATS taken in 1971: word knowledge, reading language, spelling computation, arithmetic concepts, arithmetic problem solving, science and social studies.

Although these raw data supplied by the Pittsburgh public school system were remarkably detailed and extensive we encountered several problems in attempting to exploit the data for our research purposes. These problems characterized all of our educational data. They fell into the following categories and led to significant delays. 1) Computer incompatibilities; 2) MAT changes between 1970 and 1971; and 3) inconsistent and irrelevant records. These are discussed below.

1) Relevant school system data were kept on master tapes at the Pittsburgh Board of Education building. These tapes had a density of 1600 bpi. As it turned out, the tape drives at the Carnegie-Mellon University Computation Center could read tapes with a maximum of 800 bpi. This seemingly trivial computer incompatibility became a severe issue when we learned that there was only one machine in the city capable of performing a conversion from 1600 to 800 bpi and this machine , owned by Presbyterian University Hospital, was under a heavy work schedule. In fact, it took an average of one month for each tape received from the school system to be converted so that they could be read and used at the University Computation Center. Such conversions were required on six different tapes.

2) The MAT testing history for the students on our file is displayed below.

	May 1970	Time Period	April 1971	
Test Series (1959 Edition)	Grade		Grade	Test Series (1970 Edition)
		← 10 months →		
Partial Intermediate	5	→		
Partial Intermediate	6	→	6	Partial Intermediate
Partial Advanced	7	→	7	Partial Advanced
			8	Complete Advanced

In May, 1970, the 1959 edition of the MATS was administered. Students in 5th and 6th grades took the intermediate partial tests (these did not include social science and science components). However, in 1971 the newer edition of the achievement tests published in 1970 were administered. Furthermore, while students in the 6th grade again took the partial intermediate battery, those in the 7th took the partial advanced battery. Thus it became necessary to convert scores in the different batteries and different editions to comparable values. Conversion tables were acquired from Harcourt, Brace and World, Inc., the test publishers, and computer programs were written which took the raw scores converted and these to grade equivalencies for each edition and then converted these to comparable 1970 grade equivalency scores.

In some instances, extrapolations of published conversion tables were required. Unfortunately, conversion to comparable scores for the intermediate to advanced battery was not possible and we were forced to exclude change scores of students who were in the 6th grade in 1970 and were in the 7th grade in 1971

3) For various reasons individual student records were excluded from the final student file. These included: students who resided outside of the city; students who changed schools with the 1970-1971 academic year; students who were in the 4th or 8th grades in May, 1970 or in the 5th or 9th grades in April, 1971; students whose scores were anomolous; students in schools with too few observations in a grade (< 10); students in residence areas for which census data were irretreavably suppressed or could not be identified; and students whose demographic characteristics were unknown.

In addition to the primary student file, a secondary tape file containing summary characteristics for all 93,151 students in the school system was acquired. These data were merged with printouts detailing grade-sex-race specific attendance records to create a description of the general student environment for those schools and grades for which primary test data were extant.

II. Staff File

From the Pittsburgh public schools we acquired tapes detailing school staff characteristics for all the system's schools for the years 1969, 1970, 1971 and 1972. The tapes fall into two compatible categories: 1) a certification tape and, 2) a payroll tape. The former tape is constructed following guidelines laid down by the Pennsylvania Department of Education while the latter was designed to suit the requirements of the accounting department of the Pittsburgh Public Schools. It was from data on these tapes that we expected to be able to identify and control the professional characteristics associated with the general school environment, the grade and the class of each student in our primary student file. As it will become apparent from the discussion below, we were unable to identify staff with specific students, classrooms, or even grades. Although we had initially believed that the data permitted such identification, as it turned out, however, we were forced to construct coarse combined grade and overall school characteristics variables. We detail the contents of each tape below.

1) Certification tape. This tape details the records of 389 administrative employees and 3,228 teaching personnel in the Pittsburgh public school system. Individuals are identified by their social security numbers-- a factor permitting cross checking with the payroll accounting tape. Records of each individual's demographic characteristics include: sex, marital status and age. Employment data include: institutional

location (118 possibilities), percent of time employed, teaching experience in Pittsburgh, Pennsylvania, remainder of U.S. and countries of foreign service (by country), years of education beyond high school diploma (18 possibilities), salary, current position classification (63 possibilities detailed in appendix A), number of professional employees supervised, status (full time or substitute and type), teaching assignments (107 possibilities detailed in appendix C with room for records of one major and four minor assignments), certification by type of certificate and years held (31 possibilities with room for records of three certificates), fields of certification (222 possibilities detailed in appendix D with room for records of eleven areas of certification), periods teaching and, finally, reason for termination if terminated during the past year.

2) Payroll tape. This tape created to fill requirements specified by the Pittsburgh public schools accounting department contains some data on topics which are also covered by data in the certification tape. However, in many instances the data from this tape are more disaggregate. We describe only those variables which are unique to this tape or expand on data in the previous tape. The data include: race, number of dependents, date of employment, expanded termination reasons and date termination became effective, leave status, job title, retirement status, level and step in salary scale (permits breakdown of education and experience incentives), employment category (five distinctions), position classification (439 possibilities detailed in appendix B), funding characteristics (permits identifying individuals hired with federal, state and local funds), prime location and department (with room for three locations and departments), special salary increments based on longevity, and attendance at special

programs and allowed and used sick days, vacation and other absences.

These two files were merged by using the individual's social security number as an identification. Then staff from schools identified with students in the primary student file were chosen and the others discarded. Mean, median and spread characteristics of administrative and teaching staff for grade levels (primary, intermediate and secondary) and overall schools were then computed and assigned to each student's file according to the student's school location. To these were added the general demographics of the student body and the characteristic absence rates. Thus, the working file was oriented towards individual students and contained data on variables such as the student's demographics and teacher environment thought on an a priori basis likely to influence the student's achievement level.

III. Demographic and Socioeconomic File

Our objective here was to obtain demographic and socioeconomic data of sufficient disaggregation to provide meaningful indicators of local neighborhood characteristics for student residences and school locations. Our motivation was two-fold. On the one hand, we were unable to acquire direct socioeconomic and peer data on the families of students in our primary file and thus were interested in acquiring data which would serve as surrogates for these absent direct data. On the other hand, we presumed that the neighborhood characteristics of the student's residence and school would have an effect on the student's behavior. This contextual variable was thought to operate in the following fashion: a black child residing in a low income ghetto neighborhood enrolled in the same school as a black child residing in a middle class white neighborhood would be expected to have different achievement levels all other things held constant.

To obtain data of sufficient detail and disaggregation we engaged the services of the National Planning Data Corporation of Rochester, New York. This company created a combination tape for us containing data from the 1st, 2nd and 4th count census tapes at the census block grouping (cbg) level of aggregation. A cbg is approximately 1/5 the size of a census tract and is composed of blocks chosen on less arbitrary rationales than a census tract. Essentially, the cbgs were so constructed as to be close approximations of "neighborhoods".

The complete data supplied in this tape detail demographic and socioeconomic characteristics for the Pittsburgh Standard Metropolitan Statistical Area. We decided to construct two files from these data, one containing census tract data and the other containing data on cbgs. We chose only those tracts and cbgs in which we had students and schools. Little difficulty was encountered at the census tract level. However, at the cbg level we ran into extensive difficulties caused by data suppressions built into the original census tapes by the Bureau of the Census in order to preserve the privacy of individuals when there were too few members of a classification present in the cbg. By employing some simple accounting procedures we were able to circumvent these suppressions for all variables we were interested in for all cbgs we had students in. Thus, we created a data file of extremely fine disaggregation and which is probably unmatched anywhere.

The details of the census data are contained in appendix E. From these we created a preliminary file of 43 composite variables which are listed below.

Preliminary Census Variables

1. Total population
2. Percent unrelated individuals
3. Percent black
4. Percent foreign born
5. Percent of white population under 18 years of age
6. Percent of white population over 65 years of age
7. Percent of black population under 18 years of age
8. Percent of black population over 65 years of age
9. Percent of white families with female heads
10. Percent of black families with female heads
11. Percent of population 3-34 enrolled in school
12. Percent of 16-21 not enrolled in school and not employed
13. Percent of theppopulation under 25 with under 8 years of schooling
14. Percent of the population under 25 with 9-15 years of schooling
15. Percent of the population under 25 with more than 16 years of schooling
16. Percent of the population under 5 residing in a different house in 1965
17. Percent of the population over 16 unemployed
18. Percent of white population over 16 unemployed
19. Percent of black population over 16 unemployed
20. Median family income
21. Median income of families and unrelated individuals
22. Percent of families and unrelated individuals with incomes under $3000
23. Percent of families and unrelated individuals with incomes over $15000
24. Percent of families receiving public assistance
25. Percent of related children under 18 not living with both parents and having incomes below poverty level

26. Percent of housing units rented and occupied

27. Number of individuals per housing unit

28. Number of white per white housing unit

29. Number of black per black housing unit

30. Number of white per white owner occupied housing unit

31. Number of white per white renter occupied housing unit

32. Number of black per black owner occupied housing unit

33. Number of black per black renter occupied housing unit

34. Percent of units with more than 1.51 individuals per room

35. Percent of units lacking plumbing

36. Median persons per room

37. Median house value

38. Median monthly rent

39. Telephones available per unit

40. Median age of structures in 1970

41. Median years since arrival

42. Percent of occupied units occupied during 1968-1970

43. Percent of occupied units with more than one automobile

In addition to these preliminary variables several other race-specific per capita and per family income variables were defined. Correlational analyses were performed to reduce these variables to a set which could be used as indicators of local demographic and socioeconomic conditions. Approximately ten variables have been chosen but techniques are being employed to further reduce these. These variables will then be identified with student residence and school locations in the following manner.

Through the cooperation of the South Western Pennsylvania Regional Planning Association we were able to use a special program they had developed to assign unique cbg numbers to street numbers. This procedure was employed for student residences and school locations. Unfortunately, this mapping routine was not able to assign cbg numbers to every student and a small number were excluded as a consequence. With these cbg numbers we were able to add to the enlarged student files data on the demographic and socioeconomic characteristics of their residence and school locations for both disaggregated cbg's and aggregate census tracts. Thus, the final student file contains records detailing each student's achievement behavior, personal characteristics, professional educational environment, student body environment, local school neighborhood and residence neighborhood characteristics.

The Analysis Which Is In Process:

Although we have worked with portions of the above data, we are only now beginning to analyze this data in its totality. As is traditional for any such basically empirical work, we have begun with simple regressions. These initial regressions should give us some guidance and we may then construct a more complicated model. Although all resources from our initial grant have long been exhausted, we will continue to utilize university and other resources in order to complete this analysis.

Two points are relevant here. First, we have every reason to be extremely confident that the output of this analysis will be useful. The initial analysis which is summarized below was itself very useful for the managers within the School District, and this additional analysis of this expanded set of data should be even more useful. On the other hand, we are now certain, given our work with the Coleman data, that any model which is constructed to analyze this body of data will be a misspecified model since this data does not include information concerning the efficacy, motivation, and expectations of individual students and those expectations which he perceives that his teachers and parents have for him or her. This kind of information was contained in the Equality of Educational Opportunity Survey, and our work indicates that it is very important.

The Preliminary Results:

Since among other reasons we wanted to know whether our efforts might hold a future pay off, we conducted an initial analysis upon the data which was easiest to obtain (student scores on the standardized tests including I.Q., age, sex, race, and school). The results of this analysis are contained in the enclosed paper which is titled, "Operational Accountability". One of the main purposes of this initial analysis was to determine whether there might be effects upon achievement which might be attributable to the school which a particular student attended. The answer to this question was positive. Hence, the decision-makers could inquire as to the source of the positive or negative effect upon achievement which was attributed to some particular school. Clearly, such a question is impossible without such a study as this one. However, since this study could control for only I.Q., age, sex, and race we believe that a complete analysis of the data which we have assembled will be of interest not only to the decision-makers within the Pittsburgh School System but also to the larger public which is interested in educational research. We repeat again that this paper is included so that it is to be considered a part of this final report.

Summary of the Work on the Coleman Data:

As was mentioned earlier, we secured additional resources, including a very substantial contribution from Carnegie-Mellon University, so that we might go ahead while our data was being assembled and investigate some of our ideas within the context of the existing data represented by the twelfth grade tapes of the Equality of Educational Opportunity Survey. Of course, we believed initially (and now feel that we have confirmed the fact) that this aspect of our effort would prove to be of interest in and of itself. In short, we felt that this data had never been properly analyzed so that our efforts might be useful in and of themselves.

The details of our re-analysis of the Coleman data are contained within the enclosed papers, "A Simultaneous Equations Model of the Educational Process", "Education From An Anthropological Perspective: An Empirical Investigation of Structural Differences Among Blacks and Whites", and "A Simultaneous Equations Model of the Educational Process: The Coleman Data Revisited With An Emphasis Upon Achievement". These papers are considered to be a part of this report. We might note in passing that they are still subject to revision so that the results are not yet to be considered "final". Indeed, we might note that in at least one of these preliminary drafts we forgot to thank our supporting grantors! We certainly will not make such a mistake in the final version.

All of these papers share a common basic idea. This simple idea is that the educational process has several outputs which include achievement, efficacy, motivation, and expectations. The notion is that all these must be considered to be endogenous variables so that the educational process can only be modelled through the methodology of simultaneous equations.

If the above notion is correct, and we believe that the enclosed papers indicate that it is, then all of the previous analyses of this data may be subject to what is noted within the econometric literature as simultaneous equations bias. In other words, results based upon single equation regression models may yield biased results.

We believe that the enclosed papers justify our views that the educational process must be modelled by a system of simultaneous equations. We believe that the results which we have obtained are both new and important.

Obviously we cannot go into the details here, which must be left to the included papers, but it is worth noting that not only is the endogenous part of the system important but that the exogenous part has powerful policy implications for both our nation and for accountability models. While it is now popular to argue that the resources of the educational system are not important in relation to the outputs of that system, these popular ideas are not supported by the results reported in these papers. Indeed, our results indicate that the resources of the system contribute most importantly to educational outcomes. Teachers are important as is indicated not only by the pupil-teacher ratio but also by the scores which teachers achieved on their standardized test. In a summary, the resources of the system are very important and educational outcomes cannot be attributed solely to family background, peer group, and inherited characteristics.

Conclusions:

We feel that this research project has demonstrated that accountability can be made into an operational concept. We feel that our efforts have yielded important new results. Clearly, educational systems can collect data which are similar to that contained within the Equality of Educational Opportunity Survey and such data would be a great step forward in making accountability operational. Obviously, such data can be improved upon. The first step would be to identify pupils with their teachers so that we might be better able to sort out what may be important teacher effects upon both achievement and the other outputs of the educational system. It is unfortunate that this kind of data is not automatically collected by the educational system.

Appendix A

Position Classification Code

Administrative and Supervisory

0000	Superintendent, County
0001	Associate Superintendent, County
0003	Assistant Superintendent, County
0005	Superintendent, District
0007	Associate Superintendent, District
0009	Assistant Superintendent, District
0010	Supervising Principal
0015	Administrative Assistant
0020	Secondary Principal
0025	Assistant or Vice-Secondary Principal
0030	Elementary Principal
0035	Assistant or Vice-Elementary Principal
0045	Assistant or Vice-Combined Elementary and Secondary Principal
0048	Director, Audio-Visual Services
0049	Director, Recreation
0050	Director, Industrial Education
0055	Director, Vocational Education
0060	Coordinator, Trade and Industrial Education
0063	Supervisor, Agriculature Education
0065	Supervisor, Vocational Trade and Industrial Education
0070	Supervisor, Speech and hearing
0073	Supervisor, Special Education
0075	Supervisor, Guidance
0080	Supervisor, Elementary
0085	Supervisor, Secondary
0090	Supervisor, Combined

Classroom Teachers

0405	Nursery School Teacher
0410	Kindergarten Teacher
0415	Elementary Teacher
0420	Secondary Teacher
0425	Combined Elementary and Secondary Teacher
0430	Special Education Teacher
0435	Speech Correctionist
0440	Head of Department
0445	Extension Adult Education

Appendix A (Continued)

Coordinate Services

0801 Assistant to the Superintendent in Charge of Instruction
0802 Assistant to the Superintendent in Charge of Business Affairs
0803 Assistant to the Supervising Principal in Charge of Instruction
0804 Assistant to the Supervising Principal in Charge of Business Affairs
0805 Business Manager
0807 Curriculum Coordinator
0808 Curriculum Director
0810 Dental Hygienist
0815 Guidance Personnel, Elementary
0820 Guidance Personnel, Secondary
0825 Guidance Personnel, Combined
0830 Home and School Visitor
0835 Librarian, Elementary
0840 Librarian, Secondary
0845 Librarian, Combined
0850 Manager, School Food Services
0855 Occupational Therapist
0860 Physical Therapist
0863 Psychiatric Social Worker
0864 Psychological Examiner
0865 Psychologist, County
0870 Psychologist, District
0875 School Nurse
0880 Specialist
0885 Specialist, Education Program
0890 Specialist, Research
0895 Audiometrist

9900 Others, Specify

Appendix B

PBE - POSITION CODES

1 Superintendent of Schools
2 Controller
3 Solicitor
4 Treasurer
5 Deputy Controller
6 Deputy Superintendent
7 Assistant Superintendent
8 Director (Division)
9 Director (Education
10 Director (Special Function)
11 Personal Leave
12 Vacation Replacement
13 Other Replacement
14 Overtime - Day Care Centers
15 Vacation Pay
16 Work Shop Salaries
17 Illness Replacement
18 Terminal Pay
19 Teacher Examinations
20 Annuity
21 Summer Planning
22 Pensioners
23 Summer Class Scheduling
24 Teacher Fellowship Program
25 Absence Provision
26 In-Service Training
27 Overtime
28 Sabbatical
29 Temporary Help
30 Turnover Provision
31 Committee Work
32 Salary Advance Study
33 Detached Assignment
34 Associate Director
35 Assistant Director
36 Coordinating Director
37 Assistant Chief Accountant
38 Assistant Collector A
39 Assistant Collector B
40 Assistant Purchasing Agent
41 Personnel Assistant 1
42 Administrative Assistant
43 Personnel Assistant 1
44 Administrative Assistant
45 Personnel Assistant 2
46 Assistant Solicitor
47 Special Assistant
48 Administrative Intern
49 Assistant to Treasurer
50 Assistant to Chief of Maintenance
51 Assistant to Director

Appendix B (continued)

52 Contract Overtime
53 Area Administrator - Pupil Services
54 Chief of Payroll Administration
55 Statistician
56 Planning Associate
57 Financial Manager
58 Jr. Accountant
59 Executive Assistant
60 Chief Accountant
61 Accountant 1
62 Accountant 2
63 Auditor 1
64 Auditor 2
65 Retirement Counselor
66 Accountant 3
67 Executive Secretary
68 Editor
69 Secretary 1
70 Secretary 2
71 Secretary 3
72 Secretary 4
73 Auditor 3
74 Expediter
75 Disbursement Supervisor
76 Auditor School Controller
77 Delinquent Tax Investigator
78 Planning Specialist
79 Research Specialist
80 Program Specialist
81 Research Associate
82 Classification Officer
83 Principal
84 Vice-Principal
85 Assistant Principal
86 Dean of Students
87 Administrator in Charge
88 Dean of Instruction
89 Senior Coordinator
90 Coordinator
100 Assistant Coordinator
101 Supervisor 2
102 School Volunteer Work Supervisor
103 Supervisor 1
104 Supervisor (Curriculum and Instruction)
105 Supervisors Summer Pay
106 Curriculum Writing
107 Editor
108 Editor
109 Editorial Assistant
110 Testing Assistant
110 Safety Education Assistant
111 Medical Supervisor

Appendix B (continued)

112 Dental Supervisor
113 Tabulating Supervisor
114 Security Supervisor
115 Construction Supervisor
116 Chief of Operations
117 Chief of Maintenance
118 District Custodial Supervisor
119 Property Control Supervisor
120 Tax Supervisor 1
121 Tax Supervisor 2
122 School Social Work Supervisor
123 Assistant Supervisor of Security
124 Transportation Supervisor
125 Nursing Supervisor
126 Programming Supervisor (Computer)
127 Educational Facilities Coordinator
128 Activities Director
129 Girl's Advisor (Nurse)
130 Counselors
131 Head Counselor
132 Draftsman
133 Safety Inspector
134 Designing Architect
135 Heating-Plumbing Draftsman
136 Architectual Draftsman
137 Electrical Engineer
138 Heating-Plumbing Engineer
139 Electrical Draftsman
140 Inspector Mechanical
141 Project Architect
142 Electrical Inspector
143 Senior Systems Analyst
144 Programmer - Analyst 2
145 Programmer - Analyst 1
146 Student Intern
147 Building Inspector 1
148 Building Inspector 2
149 Meaterial Expediter
150 Auto Mechanic 1
151 Auto Mechanic 2
152 TV Repairman
153 Buyer 1
154 Buyer 2
155 Buyer 3
156 Audio-Visual Technician 1
157 Audio-Visual Technician 2
158 Audio-Visual Technician 3
159 Facilities Statistical Coordinator
160 Drafting Aide
161 Design Draftsman
162 Musical Instrument Repairman

163 Chief of Heating and Plumbing Design
164 Specification Writer
165 Programmer 1
166 Data Processing Editor
167 Computer Operation Manager
168 Account Clerk 1
169 School Chief Clerk 2
170 School Clerk 1
171 School Chief Clerk 1
172 School Clerk 2
173 Library Clerk
174 Messenger-Clerk
175 Key Punch Operator 1
176 Clerk-Stenographer 1
177 Clerk-Stenographer 2
178 Clerk-Typist 1
179 Switchboard Operator 1
180 School Supply Clerk
181 Statistical Clerk
182 Substitute Clerk - Part Time
183 Substitute Clerk - Full time
184 Stores Clerk 1
185 Clerk-Typist 2
186 Clerk 1
187 Clerk 2
188 Account Clerk 2
189 Bookkeeping Machine Operator 1
190 Duplicating Equipment Operator 1
191 Duplicating Equipment Operator 2
192 Chauffeur
193 Automotive Equipment Operator 2
194 Key Punch Operator 1
195 Switchboard Operator 2
196 Tabulating Machine Operator 1
197 Tabulating Machine Operator 2
198 Tabulating Machine Operator 3
199 Mobile Unit Division
200 Automotive Equipment Operator 1
201 Transportation Helper
202 Bookkeeping Machine Operator 2
203 Junior Programmer
204 Computer Operator 2
205 Systems Analyst
206 Computer Operator 1
207 On Line Specialist
208 Teacher, Regular
209 Department Chairman
210 Teacher, Special Education
211 Teacher, Special Education-Gifted
212 Teacher, Full Time Sub
213 Teacher, Day-to-Day Sub
214 Teacher, Evening Sub
215 Teacher, Part-time Substitute
216 Teacher, Speech Therapist

Appendix B (continued)

217 Teacher, Team Leader
218 Teacher, Library
219 Teacher, Assistant
220 Teacher, Itinerant
221 Reading Specialist
222 Teacher, Kindergarten
223 Teacher, Intern
224 Teacher preparation Period Compensation
225 Physical Therapist
226 Occupation Therapist
227 Field Service Rep
228 Extra-curricular activities
229 Swim Instructor
230 Teacher Assistant 1
231 Teacher Assistant 2
232 Teacher Assistant 3
233 Teacher Assistant 4
234 Census Enumerator
235 School Social Worker
236 Choir Director
237 Band Director
238 Orchestra Director
239 Faculty Athletic Manager
240 Community Agent
241 Matron
242 Contract Reader
243 Security Aide
244 Instructional Assistant
245 Parent Involvement Worker
246 TA-2
    (TA-2 Teaching Assistant)
    (TA-2 OVT Program)
247 Student Worker
248 Field Supervisor
249 Sr. Security Aide
250 P.T. Daylight Security
251 P.T. Evening Security
252 Night Security Aide
253 Investigator
254 P.T. Summer Security Aide
255 Jr. Investigator
256 TA-1
    (TA-1 Instructional)
    (TA-1 Kindergarten)
    (TA-1 Library)
    (TA-1 Team Mother)
    (TA-1 Child Care)
    (TA-1 Team)
    (TA-1 Reading Readiness)
    (TA-1 P.E.P.)
    (TA-1 Classroom Asst.)
    (TA-1 School)

257 TA-3
  (TA-3 Adjustment Class)
  (TA-3 Resource Room)
  (TA-3 Case)
  (TA-3 Kindergarten Asst.)
  (TA-3 Learning Disab.)
258 Supervisory Aide 1
259 Supervisory Aide 2
260 School Aide (Monthly Bus Aide)
261 Field Service Aide
262 Bus Aide (Hourly)
263 Substitute Aide
264 Helper Service
265 Doctor of Medicine
266 Doctor of Psychology
267 Ophthalmologist
268 Radiologist
269 Psychologist
270 Radiologic Technologist
271 Optician
272 Dentist
273 Dental Assistant
274 School Nurse
275 Dental Hygienist
276 Nurse Clinic
277 Nurse Audiometer
278 Social Hygiene
279 Social Hygiene Lecturer
280Teacher, Speech Therapist
281 Nurse Technician
282 Group Audiometrist
283 Senior Hygienist
284 Hygienist
285 Psychiatric Social Worker
286 Psychiatrist
287 School Nurse Sub
288 Neurologist
289 Asst. Coach-Baseball
290 Sr. Golf Coach
291 Third Asst. Coach-Football
292 Intramural Wrestling
203 Second Asst. Coach-Football
204 Sr. Head Football
205 First Sr. Asst. - Football
206 Sr. Basketball
207 Sr. Baseball
208 Sr. Track
209 Sr. Swimming
210 Sr. Soccer
211 Sr. Volleyball
212 Sr. Cross Country
213 Sr. Tennis
214 Asst. Coach-Basketball
215 Asst. Coach-Track

Appendix B (Continued)

216 Intramural teacher
217 Gymnastics
218 Coach-Basketball
219 Coach-Volleyball
220 Coach-Swimming
221 Coach-Track
222 Intramural Tennis
223 Junior High Coach
224 Junion High Soccer
225 Junior High Basketball
226 Junior High Swimming
227 Junior High Softball
228 Junior High Track
229 Junior High Tennis
230 Custodian 1
231 Custodian 1-A
232 Custodian 2
233 Custodian 3
234 Custodian 4
235 Custodian 5
236 Custodian 6
237 Custodian 7
238 Custodian, Assistant A
239 Custodian, Assistant B
240 Custodian, Helper
241 Cleaner E
242 Cleaner D
243 Cleaner C
244 Cleaner B
245 Cleaner A
246 Laundress 1
247 Laundress 2
248 Itinerant Helper
249 Itinerant Cleaner
250 Parking Lot Attendant
251 Custodian 3A
252 Fireman A
253 Fireman B
254 Elevator Operator
256 Special Patrolman
257 Substitute Helper
258 Substitute Cleaner
259 Asbestos
260 Blackboard Finisher
261 Bricklayer
262 Building Laborer
263 Carpenter
264 Carpenter, Foreman
265 Carpenter, Sub-Foreman
266 Cement Mason

Appendix B (continued)

267 Composition Roofers
268 Electrician
269 Electrician, Foreman
270 Lather
271 Locksmith 2
272 Marble Setter
273 Mortar Mixer
274 Iron Worker
275 Maintenance Repairman 2
276 Painter
277 Painter, Foreman
278 Plasterer
279 Painter Sub-Foreman
280 Plumber
281 Plumber, Foreman
282 Plumbing Laborer
283 Sheet Metal Worker
284 Sheet Metal Worker, Foreman
285 Slate Roofer
286 Sheet Metal Sub-Foreman
287 Saw Sharpener
288 Steam Fitter
289 Steam Fitter, Foreman
290 Tile Setters
291 Tile Setters, Helper
292 Maintenance Repairman 1
293 Locksmith 1
294 Temporary Helper, Shop
295 Physical Edication Equipment Repairman
296 Facilities and Equipment Labor
297 Foreman
298 Storekeeper 1
299 Storekeeper 2
300 Shipper
301 Stores Clerk 2
302 Helper
303 Used Furniture Stockman
304 Foreman
305 Assistant Foreman
306 Field Caretaker 1
307 Field Caretaker 2 (Hedge Trimmer)
308 Sheet Metal Sub-Foreman
309 Saw Sharpener
310 Steam Fitter
311 Steam Fitter, Foreman
312 Tile Setters
313 Tile Setters, Helper
314 Maintenance Repairman 1
315 Locksmith 1
316 Temporary Helper, Shop
317 Physical Education Equipment Repairman

Appendix B (continued)

318 Facilities and Equipment Labor
319 Foreman
320 Storekeeper 1
321 Storekeeper 2
322 Shipper
323 Stores Clerk 2
324 Helper
325 Used Furniture Stockman
326 Foreman
327 Assistant Foreman
328 Field Caretaker 1
329 Field Caretaker 2 (Hedge Trimmer)
330 Scaffold Erection
331 Laborer 2
332 Laborer 1
333 Cafeteria Manager
334 Cafeteria Manager, A
335 Cafeteria Manager, B
336 Cafeteria Manager, C
337 Cafeteria Manager Trainee
338 Baker
339 Asst. Baker
340 Cook
341 Cook, Manager
342 Food Service Supervisor 1
343 Food Service Supervisor 2
345 Food Service Worker
346 Dietitian Manager

Appendix C

Teaching Assignment Code

0000	No Classroom Teaching
1200	Agriculture
1400	Art
	Business Education
1610	Bookkeeping
1620	Business English
1640	Retail Selling
1650	Shorthand
1660	Typing
1670	Commerical Law
1680	Commercial Arithmetic
1690	Office Practice
1695	Other
2000	Trade and Industrial
2219	Practical Nursing
2330	Distributive Education
	Elementary Education
2820	Nursery School
2830	Kindergarten
2850	Primary
2860	Intermediate
2870	Upper Elementary (Grades 7 and 8)
2880	Other Elementary
2890	Team Teaching
	English
3220	Drama
3240	Journalism
3250	Speech
3270	Combined Composition, Grammar and Literature
3280	Composition
3290	Literature
	Extension
3610	Adult
3620	Recreation

Foreign Language, Ancient

4010 Greek
4020 Hebrew
4030 Latin
4040 Sanskrit

Foreign Language, Modern

4405 Chinese
4410 French
4420 German
4430 Italian
4440 Japanese
4450 Lithuanian
4460 Polish
4470 Portuguese
4480 Russian
4490 Spanish

Health and Physical Education

4810 Health
4820 Physical Education

Highway and General Safety Education

5200 Driver Education
5400 Safety Education

5605 Home Economics

Industrial Arts

6060 General Shop
6070 Unit Shop

6400 Library Science (Classroom Only)

Mathematics

6805 Analytical Geometry
6810 Algebra
6815 Arithmetic
6820 Calculus
6825 Combined Analytical Geometry and Calculus
6830 Combined Algebra and Trigonometry
6835 Combined Geometry
6845 Elementary Functions
6855 Foundations of Mathematics
6865 General Mathematics
6875 Modern Abstract Algebra
6880 Plane Geometry
6885 Probability and Statistics
6890 Solid Geometry
6895 Trigonometry
6899 Others, Specify

Music

7210	General Music
7220	Instrumental Music

Readi[illegible]

7610	Developmental
7620	Remedial
7630	Specialized

Science

8405	Biology
8410	Biological Science
8420	Chemistry
8430	Comprehensive Science
8440	Earth and Space Science
8450	General Science
8460	Physical Science
[illegible]70	Physics

Social Studies

8805	Anthropology
8810	Civics
8820	Comprehensive Program
8830	Economics
8840	Geography
8843	Political Science
8844	Problems of Democracy
8845	History
8860	Psychology
8865	Social Science
8875	Social Studies
8880	Sociology
8890	World Cultures

Special Education

9205	Deaf and Hard of Hearing
9210	Mentally Advanced, Elementary
9211	Mentally Advanced, Secondary
9220	Mentally Retarded, Educable, Elementary
9221	Mentally Retarded, Educable, Secondary
9230	Mentally Retarded, Trainable
9240	Physically Handicapped
9250	Restoration
9260	Socially and Emotionally Maladjusted
9270	Speech Correction
9280	Speech and Hearing Handicapped
9290	Visually Handicapped

9900 Others, Specify

Appendix D

Areas of Certification Code

Administration

1100	Elementary Principal
1105	Secondary Principal
1110	Comprehensive Principal
1120	Supervising Principal
1140	Assistant Principal
1150	Superintendent
1155	Assistant Superintendent
1185	Equivalency

1200 Agriculture Education

Art

1405	Art Education
1415	Art Supervisor

Business Education

1600	Business Education
1610	Bookkeeping
1615	Data Processing
1620	Business English
1630	Business Mathematics
1640	Retail Selling
1650	Shorthand
1660	Typing
1670	Commercial Law
1680	Commercial Arithmetic
1690	Office Practice

Coordinate Services

1805	Assistant to the Superintendent in Charge of Instruction
1810	Assistant to the Superintendent in Charge of Business Affairs
1820	Instructional Media Specialist
1830	Dental Hygienist
1835	Elementary Guidance Counselor
1838	Secondary Guidance Counselor
1840	Supervisor of School Guidance Services
1841	Guidance Counselor
1850	Home and School Visitor

1860	Manager of School Food Services
1870	Occupational Therapist
1875	School Psychologist
1880	Psychological Examiner
1862	Supervisor of Special Education
1885	Physical Therapist
1890	Public School Nurse

Vocational Industrial Education

2000	Vocational Industrial Education
2001	Air Conditioning and Refrigeration
2003	Appliance Repair
2005	Automotive Body and Fender
2007	Automotive Mechanics
2009	Baker
2011	Barbering
2013	Building Maintenance
2015	Business Machine Maintenance
2017	Carpentry
2019	Commercial Art
2021	Cook, Chef
2023	Cosmetologist
2025	Diesel Mechanic
2027	Drafting
2029	Dressmaking
2030	Electronics
2031	Electrical Construction and Maintenance
2033	Electrical, General
2035	Electrical, Industrial
2037	Fabric Maintenance Services
2039	Foundry
2041	Instruments Maintenance and Repair
2043	Machine Shop
2045	Masonry
2047	Millwork and Cabinet Making
2049	Painting and Decorating
2051	Patternmaking
2053	Plastics
2055	Plumbing
2057	Printing
2059	Quantity Foods
2061	Radio and Television
2063	Sheet Metal
2065	Shoe Manufacturing and Repair
2067	Small Engine Repair
2069	Tailoring
2071	Textile Production and Fabrication
2073	Tool and Die Technology
2075	Upholstering
2077	Waiter, Waitress
2079	Welding
2101	Chemical Technology
2103	Civil Technology
2105	Drafting-Design Technology (Architectural)
2106	Drafting-Design Technology (Mechanical)

2107	Electrical Technology
2109	Electro-Mechanical Technology
2111	Electronics Technology
2113	Environmental Control Technology
2115	Instrumentation Technology
2117	Mechanical Production Technology
2119	Metallurgical Technology
2121	Scientific Data Processing
2201	Dental Assistant
2203	Dental Laboratory Technician
2205	Hospital Food Services Supervisor
2207	Medical Assistant
2209	Medical Laboratory Assistant
2211	Medical X-ray Technician
2213	Nurses Aide
2215	Occupational Therapy Assistant
2217	Physical Therapy Assistant
2219	Practical Nursing
2220	Coordinator of Practical Nursing
2221	Surgical (Operating Room) Technician
2230	Vocational Adult Extension
2300	Director of Vocational Education
2310	Coordinator of Vocational Education
2320	Supervisor of Distributive Education
2330	Teacher-Coordinator of Distributive Education
2340	Supervisor of Trade and Industrial Education
2350	Coordinator of Trade and Industrial Education

2700 Educational Program Specialist

Elementary Education

2810	Elementary Education
2820	Nursery School, Child Care
2830	Nursery-Kindergarten-Primary
2840	Early Childhood Education

English

3210	Comprehensive English
3220	Drama
3230	English
3240	Journalism
3250	Speech
3260	Comprehensive English, Reading

Extension

3610	Adult Education
3620	Recreation Education

Foreign Languages, Ancient

4010	Greek
4020	Hebrew
4030	Latin
4040	Sanskrit

Foreign Languages, Modern

4403	Comprehensive Language
4405	Chinese
4410	French
4411	Elementary French Endorsement
4420	German
4421	Elementary German Endorsement
4430	Italian
4440	Japanese
4450	Lithuanian
4460	Polish
4470	Portuguese
4480	Russian
4490	Spanish
4491	Elementary Spanish Endorsement

Health and Physical Education

4805	Health and Physical Education
4810	Health Education
4815	Health and Physical Education Supervisor

Highway and Safety Education

5200	Driver Education
5400	Education for Safe Living

Home Economics

5605	Home Economics
5615	Home Economics Supervisor

Industrial Arts

6000	General Industrial Arts
6010	Drawing (Unit)
6011	Drawing (General)
6015	Art Crafts (Unit)
6016	Art Crafts (General)
6020	Electricity (Unit)
6021	Electricity (General)
6025	Automotives (Unit)
6026	Automotives (General)
6030	Graphic Arts (Unit)
6031	Graphic Arts (General)
6035	Ceramics (Unit)
6036	Ceramics (General)
6040	Metal (Unit)
6041	Metal (General)
6045	Plastics (Unit)
6046	Plastics (General)
6050	Wood (Unit)
6051	Wood (General)
6055	Textiles (Unit)
6056	Textiles (General)
6060	Printing (Unit)
6061	Printing (General)

Library Science

6410	Elementary School Librarian
6420	Comprehensive School Librarian

6800 **Mathematics**

Music

7205	Music Education
7215	Music Supervisor

Reading

7600	Reading Teacher
7650	Reading Specialist

8000 **Recreation Coordinator**

Science

8405	Biology
8410	Biological Science
8420	Chemistry
8430	Comprehensive Science
8440	Earth and Space Science
8450	General Science
8455	Geology
8460	Physical Science
8470	Physics
8475	Physics and Mathematics
8480	Science

Social Studies

8805	Anthropology
8820	Comprehensive Social Studies
8830	Economics
8840	Geography
8842	Government
8845	History
8850	History and Government
8860	Psychology
8865	Social Science
8875	Social Studies
8880	Sociology

Special Education

9205	Deaf and Hard of Hearing
9210	Mentally Advanced
9220	Mentally Retarded
9230	Mentally Retarded, Trainable
9240	Physically Handicapped
9250	Restoration
9260	Socially and Emotionally Maladjusted
9270	Speech Correction
9280	Speech and Hearing
9290	Visually Handicapped

Appendix E

General Contents of Census Tape for Pittsburgh by Block Groupings

1 Aggregate $ Income
2 Aggregate $ Income by Family Status and Size of Family and Race
3 Urban/Rural Population
4 Race
5 Nativity, and Parentage (15%)
6 Mother Tongue (15%)
7 Country of Origin of Foreign Stock (15%)
8 Age, Race and Sex
9 Relationship and Race
10 Family Type, Number of Own Children under 18 and Race
11 Population 14 years old and over by Marital Status and Sex
12 Population 3-34 years Old Enrolled in School by Type of School (15%)
13 Population 16-21 Years old by Enrollment and Work Status, Race and Sex
14 Population 25 Years old and over by years of school completed and age
15 Population 5 years old and over by residence in 1965 and Race (15%)
16 Women 35-44 years old every married and children ever born
17 Labor Force by Race and Sex
18 Employed Population 16 years old and over by occupation
19 Employed population 16 years old and over by Industry
20 Income
21 Family Status and Size of Family and Race
22 Families by Poverty Status and Public Assistance
23 Families with Female Head by Poverty
24 Families by Poverty Status and Related Children Under 18
25 Unrelated Individuals by Poverty Status
26 Poverty Status and Age
27 Related Children Under 18 Years old by Poverty Status and Presence of Parents
28 Urban/Rural Housing
29 Count of All Housing Units
30 Tenure and Vacancy Status
31 Tenure and Race of Head
32 Persons in Unit and Tenure
33 Persons Per Room, Tenure; Race of Head
34 Units Lacking one or More Plumbing Facilities by Tenure; Race of Head
35 Units with 1.01 or More Persons Per room and with all Plumbing Facilities by Tenure; Race of Head
36 Units Lacking Access and Complete Kitchen Facilities by Tenure
37 Rooms in Unit and Tenure
38 Units for Rent that Have Been Vacant Less than 2 Months
39 Units for Sale Only that have been Vacant Less than 6 Months
40 Value
41 Gross Rent
42 Telephone Available and Tenure
43 Basement and Type of Structure
44 Type of Structure and Tenure
45 Year Structure Built and Tenure
46 Units with Selected Equipment by Tenure (15%) (20%)
47 Year Moved into Unit and Tenure (15%)
48 Units with Automobiles Available by Tenure (15%)
49 Family or Primary Individual Income and Value
50 Income and Gross Rent and Percentage of Family or Primary Individual Income
51 Units with Household Equipment (5%)
52 Heating Fuel (5%)
53 Cooking Fuel (5%)

ED117120

A SIMULTANEOUS EQUATIONS MODEL OF THE EDUCATIONAL PROCESS

by

Anthony E. Boardman and Otto A. Davis
Carnegie-Mellon University
and
Peggy R. Sanday
University of Pennsylvania

September 19, 1973

TM.004 650

A Simultaneous Equations Model of the Educational Process*

by

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and
Peggy R. Sanday
University of Pennsylvania

1. Introduction:

This paper develops and estimates a model of the educational process. Using samples from the Equality of Educational Opportunity Survey (EEOS) a number of social scientists including Coleman [4], Hanushek [7], Levin [10], Mayeske [11] and some authors in On Equality of Educational Opportunity [12], have studied the educational process but few have developed and tested an *a priori* model. Most authors have relied on a single equation, educational production function which is an unrealistic formulation. A pupil's achievement, motivation, expectations, self-concept and his or her perceived parents' and teachers' expectations are determined jointly, not independently. For this reason, this research models the educational process by a set of simultaneous equations.

Utilizing a sample of over sixteen thousand twelfth grade pupils from the EEOS combined with information on their teachers and principals, two stage least squares are used to estimate the parameters of a linear model. The sign and significance of the regression coefficients provide important guidelines for the manipulation of policy variables such as the teacher-pupil ratio, school facilities and racial composition. Additionally, the results concerning race may be somewhat surprising and perhaps depressing.

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* This is a revised version of a paper which the authors presented at the 1973 meeting of the Public Choice Society. Thanks are due to some of the attendees of that meeting for helpful comments. Thanks are also due to Professors Timothy McGuire, Joseph Kadane, and Edwin Fenton, all of Carnegie-Mellon University, and Anthony Cresswell of Northwestern University, for helpful comments and criticisms. Finally, appreciation is due to the Ford Foundation and the U. S. Office of Education for grants which helped make this work possible. Only the authors are responsible for errors and opinions.

2. Observations Concerning Simultaniety:

The publication of the Equality of Educational Opportunity Report [4], EEOR (also known as "the Coleman Report") generated a wealth of data and stimulated attempts to model the educational process.[1] Usually, the model consisted of a single educational production function in which pupil achievement depended linearly on a number of pupil, teacher and school variables as input.

With a single exception, Levin [10], no tested implicit or explicit model of the educational process considers the output variables as jointly determined. The Equality of Educational Opportunity Report (EEOR) [4] stated that of all the variables in the survey, a child's sense of control of his environment showed one of the strongest relations to achievement. But Mosteller and Moynihan [12] point out that such feelings of control could be essentially a feedback from reality. Bright students who got good marks might feel well about themselves. Thus, Mosteller and Moynihan believe that individual achievement and efficacy are jointly determined, endogenous variables. However, individual motivation and expectations, and parents' and teachers' expectations could also be jointly determined with individual achievement and efficacy.

While Levin [10] should receive considerable credit for first publishing the notion of modelling the educational process by a set of simultaneous equations, he appears to utilize only sixth grade whites from the northeast for a sample, and even seems to have estimated his model incorrectly. Levin's diagramatic model includes interaction between a student's verbal achievement, his efficacy and motivation, with parents' attitude as exogenous. However, in the first stage regressions, Levin treats parents' attitude as endogenous. Furthermore, Levin excludes pupil's and teachers' expectations as well as additionally important exogenous variables. In short, his model constitutes an incomplete but very valuable step in the right direction.

---

[1] There have also been some interesting comments both on this study (EEOR) and on the use of the findings for educational policy. See Bowles and Levin [2] and Cain and Watts [3] as well as the studies reported in Mosteller and Moynihan [12], including the paper of Coleman himself. Hanushek's study [7] is most carefully done but is not yet well enough known.

Since the Office of Education first published the EEOR, a number of social scientists have reanalyzed portions of the original data.[1/] A series of papers edited by Mosteller and Moynihan [12] contain the most recent research in which Levin's work is completely overlooked, except perhaps by Marshall Smith who refers to Levin without giving this reference in his bibliography.[2/] These reanalyses more or less duplicate the methodology of the EEOR, and concentrate on whites in the urban north (mainly New England) to the exclusion of other regions of the country. Other articles, in the same book, present but do not test simple recursive or simultaneous models. Armor, for example, presents a simple recursive model but estimates only one equation of the model.[3/] Dyer presents two interesting simultaneous models but does not verify them empirically.[4/]

1/ These reanalyses include Bowles and Levin [2], Hanushek [7], Levin [10], Mayeske [11], and the Report of the U. S. Commission on Civil Rights [13].

2/ Smith is the author of Chapter 6, "Equality of Educational Opportunity: The Basic Findings Reconsidered," in Mosteller and Moynihan [12].

3/ Armor is the author of Chapter 5, "School and Family Effects on Black and White Achievement: A Reexamination of the USOE Data," in Mosteller and Moynihan [12]. Armor also discusses the evidence from the Coleman Report [4] in his analysis of Bussing [1].

4/ See chapter 9, "Some Thoughts About Further Studies," in Mosteller and Moynihan [12], and Chapter 12, "The Measurement of Educational Opportunity," also in Mosteller and Moynihan [12].

In accordance with Levin and the suggestions of the above authors, this research treats a pupil's achievement, efficacy and motivation as determined simultaneously. Additionally, this work regards a pupil's expectations and his perception of his parents' and teachers' expectations and attitudes as endogenous. If the construction and estimation of a simultaneous equations model of the educational process succeed, then the estimated regression coefficients of a single educational production function may be biased and inconsistent.[1/]

3. A Model of the Educational Process:

The discussion centers around the two sets of variables, the endogenous and the exogenous, and concentrates upon the former. A full discussion of the exogenous part of the model appears in the sections reporting the results.

Clearly, Mosteller and Moynihan believe that a pupil's achievement and efficacy may be jointly determined. High achievement results in high self-concept and a high self-concept leads to higher achievement. Similarly, a student who expects to succeed may perform better than one who does not expect to succeed. Obviously the converse relationship also holds, that is, expectations depend on past performance. In some ways self-concept,

---

[1/] Among many other places, the basic theorems concerning bias and inconsistency for single equation least squares estimates of simultaneous equation phenomena are presented in Dhrymes [5].

control of the environment and expectations seem highly interelated. What a person presently feels about his future success must correlate highly with what a person feels about himself at the present time, but the two sets of attitudes may be jointly determined by other variables and they may not, in fact, directly influence each other.

The Protestant work ethic is part of our culture and states that the harder a person works, the better he will do. So motivation should affect achievement. In turn, good performance may give pleasure to students which may lead to greater effort. On the other hand, some of the poorer students may work harder in an attempt to catch up.

The harder a person works, the better he expects to perform. Thus, motivation should affect expectations. Now for the opposite causal link: students who expect to do well may or may not work harder as a result of these high expectations. A pupil with low expectation may say to himself something like, "I doubt if I'll ever be any good so why bother to work" or alternatively, "I doubt if I'll ever be any good but the only way to succeed is to work." In short, there is no obvious causal link from expectations to motivation in so far as willingness to work measures motivation.

The relationship between motivation and efficacy is not so clear cut, _a priori_. A pupil with a belief in his own ability to control the environment may see the value of working in order to achieve and yet that pupil may not be willing to work hard. A tenuous _a priori_ link goes from efficacy to motivation. The opposite relationship, from motivation to efficacy, should depend on an intervening variable, achievement. Pupils who work hard and do well should have a higher efficacy while pupils who work hard but perform badly should have a low efficacy. Little work and good performance should lead to high efficacy while little work and poor performance probably cannot raise a pupil's self concept and may confirm or reinforce an already unhappy feeling about himself. Whatever the level of motivation, high achievement increases self concept while a poor performance decreases it. Motivation should have no direct effect on efficacy. Denoting achievement by ACH, motivation by MOT, efficacy by EFF, expectations by EXP, strong a priori causality by solid lines, and weak a priori causality by dotted lines with arrows indicating directions, the following diagram summarizes the above discussion:

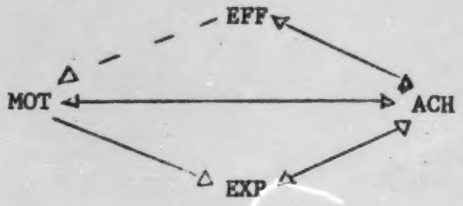

Figure 1.

This model includes two other endogenous variables: perceived parents' and teachers' expectations. Sociologists and Psychologists have long assumed that a child's attitudes depend upon his parents' attitudes. Perceived parental attitudes are relevant, not the actual parental attitudes (although perceptions probably depend highly on actual attitudes). Pupils expectations may depend on both teachers' and parents' expectations. Children probably believe their parents more than their teachers and the relationship from teachers' expectations to pupil's expectations may be weak since one teacher must relate to many pupils. From a desire to live up to the expectations held by respected older people, children probably respond to high perceived parental and teacher expectations with greater effort and generally higher motivation. Similarly, low perceived parental and teachers expectations may not provide the student with a challenge and probably lead to low motivation. A pupil may also base the feelings about himself on what he perceives his parents and teachers think about him and his expectations. However, no a priori reason exists why pupil achievement should depend directly on perceived teachers' and parents' expectations. These effects upon achievement should operate through intervening variables. Denoting perceived teachers' expectations by TEXP^{P} and perceived parents' expectations by PAEXP^{P}, the following diagram summarizes the discussion to date:

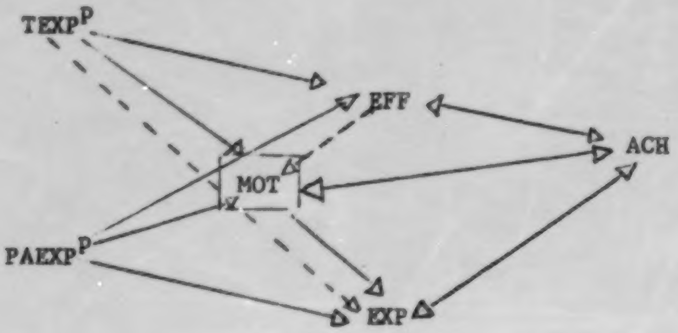

Figure 2.

Perceived teachers' and parents' expectations should depend upon actual teachers' and parents' expectations, which are unobserved variables. Actual parents' and teachers' expectations may depend on the pupil's own expectations and, presumably, his motivation, achievement and efficacy. Finally, some parents may base their expectations and attitudes about their child on feedback from teachers, while teachers probably have no alternative but to form their own independent opinions about a child.

Denoting teachers' and parents' actual expectations by TEXP and PAEXP, respectively, the following diagram summarizes the above.

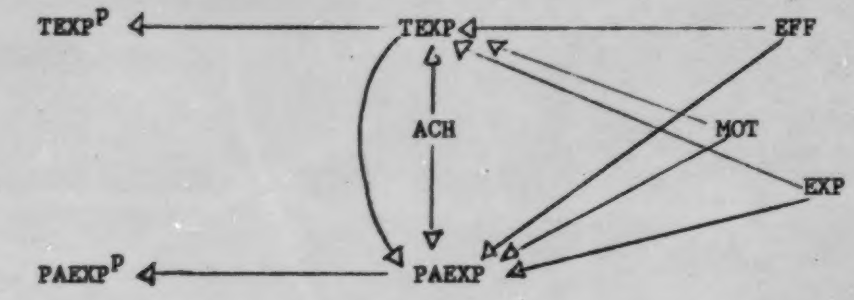

Figure 3

Figures 2 and 3 neatly summarize the postulated a priori relationship between the endogenous variables. A list of all the variables (endogenous and exogenous) appears in Appendix I along with an explanation of how they are measured and constructed. Lack of space necessitates excluding a section discussing the expected relationship between the exogenous and endogenous variables. The discussion of the findings in section 6 pays more attention to the exogenous variables.

4. The Data and Estimation Procedure:

Due to its comprehensiveness, testing the model described above requires a very large body of collective data. While time series data would be best, no data exist which contain more than a small proportion of the required information. The cost of collecting new time series data prohibits such action. The extensive data gathered for the EEOR become the only choice. Jencks, in OEOEO [12], Bowles and Levin [2], Cain and Watts [3] have discussed and criticized the EEOS data. Jencks finds the data are considerably more reliable for the ninth and twelfth grades than for earlier grades. This research uses twelfth grade student data.

Unfortunately, proportionately more minority students than White students have dropped out by the twelfth grade. In order to ensure a sufficient sample of minority students, this research sampled all of the minority students on the tapes except Blacks whose sample size was limited to 5,000. The authors carefully refined all of the data and discarded students who failed to respond to the achievement questionnaires or to carefully selected background and information questions. The authors recoded non-responses whenever necessary.

The sample used in this research consists of 16456 twelfth grade pupils from all regions of the United States and of all ethnic backgrounds combined with information on the students' teachers and principals. Two stage least squares estimates the model and the table in Appendix II contains the results.[1] Since teachers' and parents' actual expectations are unobserved, the authors combined some equations of the original model. Two of the equations are, from figure 3:

$TEXP^P = f_{4.1}$ (TEXP, plus exogenous variables) 4.1

$TEXP = f_{4.2}$ (ACH, MOT, EXP, EFF, plus exogenous variables)4.2

Assuming linearity and substituting equation 4.2 into equation 4.1 gives

$TEXP^P = f_{4.3}$ (ACH, MOT, EXP, EFF,plus exogenous variables) 4.3[2]

which corresponds to the *a priori* formulation of the last estimated equation. The equation for perceived parents' expectations is derived in a similar fashion.

5. Findings for the Endogenous Variables:

The estimated model does not correspond exactly to the *a priori* model. The following diagram reprsents the estimated relationships between the endogenous variables where the level of significance for each endogenous variable exceeds 0.05.

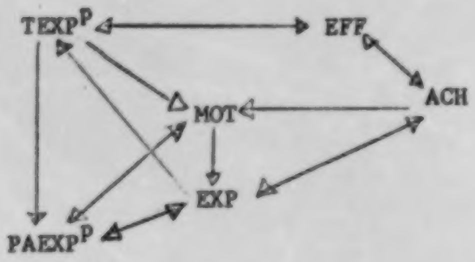

Figure 4

1/ The tables contain first and second stage regression coefficients for each variable and the t statistics, in parentheses. The structural form equations include only variables whose t-statistics exceed 1.645 in absolute value which corresponds to a level of significance of 0.05 for a one tailed test. In the tables, MLR^2 stands for the R^2 calculated from the structure form coefficients and using the actual numerical values for an endogenous variable while ALT^2 stands for the R^2 using the values of the endogenous variables predicted from the first stage.

2/ When estimating this equation, the authors find insignificant coefficients for ACH and MOT.

Individual motivation, expectations, efficacy, and perceived parents' and teachers' expectations influence pupil achievement; but all the variables do not influence achievement directly. Only individual expedations and efficacy have a direct effect.[1]

The significant effect of individual efficacy suggests that increased learning takes place when students have confidence in their own ability and feel that the"environment" is not against them. One particularly interesting chain relationship is the influence of perceived teachers' expectations on individual efficacy which, in turn, affects achievement. This chain suggests that teachers can have an effect upon achievement by teaching students to have confidence in themselves and their ability to succeed. This perception, of course, might have something less than a perfect correlation with the teachers' actual expectations for the student.

Pupil's expectations is the only other variable directly affecting achievement after excluding influences that are insignificant at the 0.05 level. Many of the effects of the endogenous variables upon achievement operate indirectly through their effects upon student's expectations. Motivation and parents' expectations do not have a significant direct effect upon achievement,[2] but they exert indirect influences by their positive effects upon students' expectations. Strong motivation leads students to expect to do well and this increased expectation leads to improved performance.

A pupil's perception of his parents' expectations of his achievement both affects and is affected by his own expectations. If a student expects sucess then he is more likely to perceive that his parents expect him to perform well, and this perception in turn leads to an increased individual expectation of his ability to achieve. This increased individual expectation leads to improved performance. Parents' expectations has this direct effect upon a student's own expectations, and also an indirect effect via motivation. In other words, if a student perceives high parental expectations, then these expectations motivate him to fulfill these aspirations.

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[1] Levin's two stage least squares results [10] with verbal score as the dependent variable show a significant coefficient for efficacy, but he does not include a variable for student expectations. Of course, our results support the EEOR's conclusion that student attitudes are extremely important.

[2] Levin also obtains the significant structural form coefficients for motivation and parents' attitude.

Contrary to what might have been thought a priori, a student's perception of his parents' aspirations for his achievement is not directly affected by his academic performance. Instead, this perception is related to his individual expectations, motivation, and his perception of his teachers' expectations of his performance.[1]

Similarly, a student's perception of his teachers' expectations does not depend directly upon his own academic performance. Instead, this perception depends on his own expectations concerning his ability to achieve and his own self confidence. His own expectations are not directly influenced by his perception of his teachers' expectations. The teachers' expectations have only indirect influences by affecting efficacy, motivation and the student's perception of his parents' expectations. Both parents' expectations and his own motivation affect his own expectations which in turn influence achievement. This interrelated chain of influences suggests that teachers have an important indirect effect upon their students' academic performance. Among the endogenous variables, the teachers' influence appears to be largely that of shaping attitudes, instilling confidence in the students, motivating them, and affecting their belief about whether there is a reward for hard work and whether effort, rather than luck, might be the most important ingredient in determining their destiny.

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[1] Levin [10] estimates a model which does not allow for any feedback from these variables to parents attitudes. Marshall Smith in OEOEO [12] believes that parents' attitudes depend directly on their childrens achievement, but he does not test this hypothesis and our research fails to support it.

This evidence indicates that among the endogenous variables, motivation depends primarily upon students' perception of the expectations which parents and teachers have for their academic performance. The student's own achievement has only a small positive feedback to his motivation.[1] These results serve to highlight the roles which teachers and parents play in motivating students by simply getting them to perceive that they are expected to achieve.

Finally, one should note that not only is achievement directly influenced by expectations and efficacy, but these variables are also affected by achievement.[2] Hence students who perform well are likely to have relatively high expectations and are more likely to have confidence in their ability to succeed. These variables, in turn, contribute to performance. This evidence tends to confirm the old idea that success breeds success.

6. Findings for the Exogenous Variables:

This section considers the influence of the exogenous variables. Although the achievement equation is emphasized, all equations are considered as the discussion proceeds to various groups of exogenous variables.

6.1 Region, Race and Individual Demographic Characteristics:

At least since the Coleman Report [1], a great deal of interest has focused upon the difference in educational achievement between the races. Our results document the fact that there are substantial differences. Relative to Orientals and Whites, the minority groups achieve poorly on the average.[3] The coefficients for the dummy variables representing

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[1] Levin [10] also finds an effect of achievement on motivation.

[2] Levin [10] also obtains an important feedback for achievement is efficacy.

[3] In fact, Orientals have a higher achievement score than Whites after controlling for all of the significant variables. This result may surprise the test designers who aimed to set a culture biased test in favor of the White majority.

Blacks, Puerto Ricans, Mexican Americans, and American Indians are all negative and highly significant in the achievement equation.[1] Whatever race indicates, it obviously relates importantly to educational achievement.

The racial results for the other equation may be somewhat surprising. While all minority groups appear to be highly motivated relative to the omitted group, Blacks are the most motivated of all. In addition, Blacks tend to be high in terms of expectations for future education and jobs and, as a group share with Whites the best image of and belief in themselves.[2] Further, in terms of both parents' and teachers' expectations, the estimated coefficients for Blacks are positive and significant. Thus, Blacks have all these endogenous variables working to increase their achievement although their actual performance as a group lags considerably behind that of Whites and Orientals.[3] This entire pattern of results indicates that the estimated coefficient for Blacks in the achievement equation should be larger in absolute value in the structural form than it is in the reduced form. In fact, such is the case. Interestingly, in the structural form Orientals have a negative and significant coefficient for teachers' expectations while Whites have a negative and significant coefficient for parents' expectations.

The use of dummy variables for the various regions of the U. S. represents an attempt to take into account the possibility that educational systems and processes may differ importantly across the country. The most significant finding here is the significant and negative coefficient for the southeast and southwest regions in the achievement equation. Students in these areas tend to score lower, on average, than students from other regions. On the other hand, the estimated coefficients for those regions are positive and significant in both the motivational and the teachers' expectations equations. Hence, students in these regions tend to be highly motivated and perceive that their teachers expect them to do well. Interestingly, students from the plains states have on average, both the highest achievement level and the most self confidence. Of all the regional variables, the northeast bears the most similarity to the excluded category, the far west.

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[1] The excluded category consists of students who fail to answer the race or background questions or cannot put themselves in any of the listed categories.

[2] The EEOR [4] also notes that Blacks are especially oriented toward the school as a path for mobility.

[3] The beta coefficient in the structural form achievement equation for expectations equals 0.602 * 1.666/3.664 = 0.272 and, for efficacy, equals 0.341 * 3.609/3.664 = 0.336. The difference between the structural form coefficients for Blacks and Whites equals 1.989 which corresponds approximately to 0.52 standard deviation from the mean. The sum of the beta for expectation and efficacy exceeds the equivalent measure of the difference between the mean achievements for Blacks and Whites after controlling for all of the variables in that equation

Students who live in metropolitan areas, SMSA, tend to achieve better than rural pupils. This tendency for better achievement is reinforced by the fact that these students also perceive that their parents expect more of them. On the other hand, pupils who reside in rural areas tend to have greater confidence in their ability.

The strong negative coefficient for sex in the structural form achievement equation indicates that males perform better than females at the twelfth grade. One reason for this result may stem from females adopting a more submissive role as they near the completion of high school. (More than 50% of the total female population marry before the age of 21.) However, females tend to have higher motivation and greater self confidence and belief in their control of their own destiny which dampens the total effect of sex upon achievement.[1] On the other hand, females peceive that their parents have lower expectations of them.

The significant negative coefficient for age in the structural form achievement equation reflects the fact that school systems tend to advance the ablest student at a rate faster than average while requiring the poorer student to repeat certain grades.[2] Thus, one naturally expects the system to produce a negative coefficient for age. Additionally, older twelfth grade students tend to have lower expectations and less self confidence which, in turn, further reduces achievement. Age enters positively only in the equation for parents' attitudes.

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[1] Levin [10] also finds that females have a significantly higher efficacy than males. However this equation is the only one for which sex entered significantly.

[2] Even at the sixth grade, Levin [10] finds evidence of this result. Age fails to enter significantly in any of his other equations.

6.2 Community and Home Variables:

At least since the appearance of the EEOR, researchers have argued that the home has a profound effect upon achievement. This study also supports this view.

As expected, the more older brothers and sisters that a person has, the worse he performs, on average. Parents give more attention to the first children for the simple reason that with more children in the family, a parent can devote less time to any one. Any benefit derived from the older brothers and sisters is insufficient to overcome less attention given by the parents. The number of older brothers and sisters also has a negative influence on self concept (efficacy) and the pupil's perception of his parents' expectations. On the other hand, this variable relates positively to perceived teachers' expectations, perhaps, because parents believe that younger children can learn from the older ones.

Although many studies agree that socioeconomic status, SES, has an important effect on achievement, this variable is not included in the achievement equation on the a priori ground that no adequate reasoning justifies its inclusion when one controls for information available to the pupil, which, in fact, correlates 0.55 with SES.1/ SES enters strong positive in the pupil's expectations and efficacy equations and thus indirectly exerts a significant influence on achievement. Additionally, pupils perceive that their parents have high aspirations for them when they come from high socioeconomic

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1/ When included in the achievement equation, SES enters with a strong positive coefficient, the coefficient for INFO becomes insignificant and the significance of pupil's expectations is reduced considerably but still remains significant at 0.05 level. While the magnitude and significance of the dummy variable for Orientals increases, the coefficients for the other race variables all fall slightly in absolute value. Little else changes. Levin [10] finds that his measures of SES including possessions in the home and father's education have no significant relationship with verbal score.

backgrounds.[1] On the other hand, SES has a significant negative effect on motivation. Pupils with a low SES may see education as an excellent if not the only way to improve their status and, for this reason, may work harder than pupils from a high socioeconomic background. The negative coefficient in the perceived teachers' expectations equation may be due to teachers encouraging disadvantaged students.

Of all the exogenous variables in this study, the amount of information available to the pupil, INFO, relates most consistently to the endogenous variables. On average, pupils with more available information have higher achievement, more motivation, greater self confidence and belief in the ability to control the environment, and higher expectations. These results may provide justification for free libraries and subsidies or special rates for students buying magazines, books and newspapers.

American families firmly believe in staying together for the sake of the children. The positive coefficient for TWOP, two parents alive and living at home, in both the reduced form and the structural form achievement equations suggests that this conjecture has a certain validity. Furthermore, the positive coefficient for this variable in the structural form equation for perceived parents' expectations indicates that parents firmly believe it which, in turn, increases achievement by the influence of parents' expectations on pupil's expectations.[2]

Those students who rarely speak a foreign language in the home, FL, seem to have a higher motivation after controlling for all of the other variables, but the expectations of these students are, on average, and somewhat unrealistically, less than those of pupils who frequently speak a foreign language.

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[1] Levin [10] obtains a similar result.

[2] Levin [10] fails to enter similar measures in his achievement equation. He finds that mother's identity seems to increase parents'attitudes while father's identity does not enter significantly in any of his structural form equations.

A priori, one might think that reading before school, RBS, should have no influence on achievement at the twelfth grade since the benefits should accrue at earlier grades and not continue until the twelfth grade. The results support this conjecture. However, this variable appears to have permanent effects on a pupil's self concept and expectations which, in turn, improve achievement scores.

Parents' concern, measured by parents talking about school, PTAS, does, *a priori*, increase achievement. However, when included in this equation of the model, the regression coefficient for this variable contradicts this hypothesis. Unfortunately, the most plausible explanation is disappointing. Parents talk about school only when their children perform poorly. As expected, the pupils perceived parental expectations are higher, on average, the more frequently parents talk about school. Another measure of parents' concern, attendance at PTA meetings, PTAAT, seems to be related postively to higher expectations, but nothing else.

Watching television, NHWTV and NHWTV^2, appears to have no direct influence on achievement. However, the sign of these two coefficients in the motivation and expectation equations suggest that a little time spent watching television may be beneficial while too many hours spent this way may have negative returns.

Apparently, spending most of one's life in one place, TC, increases a pupil's motivation, perhaps by inducing competition among local friends. However, moving around does seem to increase a pupil's expectations. It has no apparent effect on the other endogenous variables. Changing school frequently, NTCHSCL, appears to directly decrease a pupil's expectations, on average, but increases a pupil's perception of his parents' expectations. The positive coefficient for the last time a pupil changed schools, LSTCHSCL, in the achievement motivation and efficacy equations argues that all these components of education are supported by geographical stability. Curiously, but consistent with the positive sign of NTCHSCL, this variable has a negative effect upon the pupil's perception of his parents' expectations. While the policy implications about the effect of the community on the educational process are not clear, geographical stability does appear on the whole to increase most of the individual educational outputs and the reduced form suggests that all may be increased.

6.4 School Variables: The Peer Group:

At least since the appearance of the Coleman Report [1], the peer group has been emphasized as an important contributor to individual achievement. *A priori* reasoning suggests that the average achievement level of pupils, AVACH, should increase the achievement level of an individual pupil. The positive reduced form and structural form coefficients for this variable in the achievement equation support this conjecture. A secondary reason for including pupil's average achievement stems from the criticism by educators and sociologists that one cannot reasonably consider teacher effects as exogenous with individual pupil data.[1] The argument is that bright pupils attract better teachers and this phenomenon might result in observed but spurious positive coefficients for measures of teacher quality in an achievement equation. These coefficients should not be spurious here since we control for average achievement.

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[1] See, for example, Christopher Jencks in OEOEO [12], pp. 82-83.

For reasons similar to those discussed above, average motivation, expectations and efficacy should enter their respective structural equations positively and significantly. The estimates confirm this reasoning.

The significant negative coefficients for MLYBLACK and MIX in the structural achievement and efficacy equations indicate that pupil's achievement and efficacy [1] are higher in schools with a greater percentage of Whites. After controlling for the race of the pupil, and the proportion of Whites in the school, the proportion of Whites in the classroom, PWPICLY, is also associated with higher individual pupil achievement. Consistent with previous results, pupil's motivation and perceived teachers' expectations seem to be higher in mainly black schools, after controlling for all the other variables. Inconsistent results hold for the expectations equations; expectations seem to be higher in the mainly White schools, but slightly lower for the classroom with a high proportion of Whites. Interestingly, perceived parents' expectations seem unaffected by the proportion of Whites in the school or the classroom. [2]

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[1] The EEOR [4] finds that as the proportion of White pupils in the school increases, the pupil's control of the environment increases, but self-concept decreases. This result lead the authors to suggest that school integration has conflicting results on the attitudes of minority children. Our results suggest that school integration has a positive effect though more work needs to be done on estimating simultaneous equations models for the individual ethnic groups before making firmer decisions. Surprisingly, Hanushek [7] concludes that the independent effect of student body composition on achievement is small or nonexistent.

[2] Levin [10] excludes the percentage of White students from all of his structural equations except parents' attitude for which he obtains a significant negative relationship between the two variables.

6.5 School Variables: Teachers' Characteristics:

Recent years appear to have witnessed increasing acceptance of the argument that variables associated with the schools contribute little to educational outcomes.[1] These results do not support this argument. They suggest, for example, that teachers make a significant contribution to the educational process. Teachers' ability, measured by an achievement test, has a very strong direct influence on pupil's achievement. Even the number of teachers per pupil, which is often thought to be an irrelevant number, appears to significantly increase a pupil's achievement. On the other hand, for some reason, this ratio appears to reduce parents' expectations. Teachers' experience, measured by the number of years teaching, has a quadratic effect on both achievement and efficacy. As the number of years of teaching initially increases, pupil's performance falls off, but later, as teachers gain experience and perhaps as less able teachers leave the system, pupil's achievement increases.[2] Exactly the opposite quadratic effect obtains for students' perception of the expectations which teachers have for them. While this last result may be surprising, it is consistent with the effects of the other variables in this equation.

1/ For example, see Jencks [8] who is probably the most popular expositor of this idea.

2/ In his achievement equation Levin [10] obtains an insignificant coefficient for teachers' ability but a large positive coefficient for teaching experience. Contributors to OEOEO [12] including Armor, Jencks and Smith present inconsistent results but their general conclusion is that teacher effects are very small or nonexistent. In a study of third grade White Californian pupils, Hanushek [6] finds that for children of manual workers teacher verbal ability has an important effect on verbal score but teacher experience is insignificant. However, with a similar sample of children from nonmanual backgrounds, teachers' ability does not appear to be significant, while teachers' experience assumes importance. In Education and Race, Hanushek [7] argues that neither his study nor other studies support the contention that class size influences student achievement levels. He stresses the importance of teacher verbal ability and the proportion of White teachers. Our study supports this latter view but also indicates that even Hanushek may have underestimated the significant impact of teachers on the educational process.

The proportion of White teachers significantly increases achievement, motivation, and efficacy which suggests that on the average White teachers are better at their jobs, whatever the reason. Female teachers appear to have an important positive effect upon achievement and upon students' perceptions of what their parents expect of them but a negative effect upon perceived teachers' expectations. The proportion of teachers spending most of their lives in the city or town where they presently live, TPTC, has a direct effect on perceived teachers' expectations.

Unfortunately, this body of data does not include a variable for the degree of interaction between the pupils and the teachers in the classroom, nor are there measures of teaching materials. However, this body of evidence does suggest that teachers' characteristics are, on the whole, an important component in the educational process.

6.5 School Variables:

These results also suggest that variables associated with the school are important to the educational process. School facilities, for example, enter positively and significantly both the reduced form and structural form achievement equations but negatively in the equations for motivation and teachers' expectations. Problems in the school, PROBLEMS, an index including problems of drinking intoxicants, drugs, discourtesy to teachers and damage to school property, has a significant negative coefficient in the reduced form and structural form equations for both achievement and motivation. Even AGES, an index which measures the age of the school, is negatively associated with perceived parents' and teachers' expectations and enters positively in the motivation equation. The number of teachers who leave the school, NTCHLV, enters a positively in the achievement equation.

Given the generally high rate of turnover among teachers, the sign of this coefficient may reflect the higher level of turnover at those schools which insist upon exceptional performance from their teachers and which have tough tenure policies. Perhaps related to the above somewhat surprising result, the perception on the part of the teachers of a lack of effective administrative leadership, (TPADTN), is positively related to achievement. Since the mean of that variable appears rather low, one might speculate that only the better and more perceptive teachers recognize such problems. On the other hand, this variable is negatively related to perceived teachers' expectations.

Schools which have a principal with an advanced degree tend to have students with higher expectations for their own performance and achievement. Perhaps not surprisingly, schools which have a policy of administering achievement and I.Q. tests to their students also have pupils who score significantly higher on the various tests which are used here to measure achievement. Students who talk more often with guidance counselors tend to have higher expectations and a greater sense of their own efficacy. On the other hand, they also perceive that their parents expect less of them than those who do not make much use of the guidance counselors. Perhaps, because they view frequent visits to the guidance counselor as a sign of poor achievement, undecidedness and future difficulty.

7. Concluding Remarks:

The results reported here should be regarded as no more than a second step in the development of a suitable model of the educational process. Yet this effort does seem, at least to the authors, to be a significant advance beyond the first step where the process was viewed as being no more than a single equation. There are strong a priori reasons to believe that the system is simultaneous and these reasons appear to be empirically justified by both the results reported here and all the preliminary analyses which are not reported.

The simultaneous approach produces estimates which both tend to support some of the findings of previous studies and tend to be somewhat different from other results. It may be worthwhile to review briefly some of the high points before indicating what may be an appropriate third step in developing models of the educational process.

First, at least since the EEOR, [4] researchers have emphasized the importance of parents and variables associated with the home. The above work certainly is in general agreement with the notion that the home is important. However, while other studies, especially the EEOR, viewed the home as something given, the above results indicate that even home variables may be somewhat manipulable. Most importantly, parents' expectations, which have an important influence upon pupil's expectations, do in fact depend to a certain extent on manipulable school characteristics. The existence of information in the home as evidenced by books, magazines, encyclopedia and newspapers is importantly related to achievement, motivation, expectations, and efficacy. Furthermore, reading before school, even for twelfth grade pupils, is related to both expectations and efficacy. Hence, there are actions available to change home factors, at least at the level of giving advice to parents.

Peer group influences have also been emphasized in the literature. The results reported here do not deny the importance of peer groups and the measures of average achievement, motivation, expectation and efficacy enter importantly into the structural equations. Yet, one might legitimately wonder whether these school-wide averages are adequate indices for the measurement of peer group influences and question whether the empirical results should be accorded such an interpretation rather than merely being instruments to help control for bias and spurious relationships as was argued above.

Recently, Armor restarted an academic discussion on the integration issues. In this paper, interest centers upon measures of the racial composition of the schools in an effort to determine how these relate to the endogenous variables. Perhaps unfortunately, no single clear policy, such as integrate, segregate, or bus, emerges. Instead, the effects which appear to be both strong and important, indicate that the picture is much more complex than might be expected from popular discussion or even some of the previous studies.

There appears to be a growing belief that inputs into the educational process are almost unrelated to outputs. This study does not support such a view. Teachers, for example, even with the crude measures available here, appear to be very important. The much discussed pupil-teacher ratio, believed by parents to be important but often viewed as irrelevant by researchers and administrators, is strongly and positively related to achievement. Similarly, the intelligence of the teachers, as it is measured by their own score on a verbal aptitude test, is important for achievement. Similarly, even variables associated with the school, such as facilities, appear to be important in the educational process. [1]

Finally, there should be a brief discussion of the direction in which further research might go. There is no doubt but that this body of data is very rich. It should be studied for some time to come. Our own directions, at least for the near future, are (1) to disaggregate the twelfth grade data in an effort to determine whether we should be discussing one educational process such as the one given above, or a number of educational processes depending upon the region of the country and the race of the pupils, (2) to estimate the model with data from the ninth grade which includes pupils who may drop out before the twelfth grade, and (3) to consider additional outputs of the educational process such as the number of graduates per annum or the happiness of the pupils.

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[1] This finding supports Mayeske's [11] overwhelming impression that schools are indeed important.

APPENDIX I: DESCRIPTION OF THE VARIABLES

Endogenous Variables:

Abbreviation	Variable Name	Mean	Standard Deviation	Description
ACH	Achievement	0.099	3.664	An index* constructed from the following standardized variables: verbal right (VR), nonverbal right (NVR), reading right (RR), math right (MR) and general information total right (GITR). (A high score indicates many correct answers.)
MOT	Motivation	-0.005	1.739	An index constructed from the following standardized variables: go far in school (FARSCL), happy to quit school (HPYTOTSCL), desire in school (DESINSCL), number of hours study (NHRSTUDY), number of days stay from school (NDSTAYFS), participation in athletics, student council, debating (PART). (A high score indicates high motivation.)
EXP	Expectations	0.020	1.666	An index constructed from desire to go to college (COLLEGE) and job expectations (JOBEXP). (A high score indicates high expectations.)
EFF	Efficacy	0.016	3.609	An index constructed from the following standardized variables: people are happier who accept their condition (EACPT), good luck is more important than hard work for success (EHWORK), get ahead somebody stops me (EAHEAD), lack of success is own fault (ESUCCESS), whatever education hard to get job (EHJOB), would make any sacrifice to get ahead (ESAC), would like to change to be somebody different (ECHANGE), sometimes can't learn (ELEARN), teachers go too fast (EFSTTCH), not much chance for success (ECNCESUC), tougher the job harder work (ETGHJOB), able to do many things (EABLE). (A high score indicates a high feeling of control and self-concept.)
PAEXP^{P}	Perceived Parents' Expectations	0.018	2.332	An index constructed from the following standardized variables: mother's and father's desire about student's performance in class (MOSEXP and FASEXP, respectively), father's and mother's expectations about the student's future education. (FAJEXP and MOJEXP, respectively). (A high score indicates high parental expectations.)

* All indices came from the first factor of a principal components analysis.

Endogenous Variables (continued)

Abbreviation	Variable Name	Mean	Standard Deviation	Description
TEXP^P	Perceived Teachers' Expectations	-4.269	1.615	Teachers expect student to be one of the best in class = -2, good enough to get by = -8 (A high score indicates high teacher's expectations).

Exogenous Variables:

Abbreviation	Variable Name	Mean	Standard Deviation	Description
CONST	Constant	1.000	0.000	
AVACH	Average Achievement	0.113	0.533	Average Achievement for pupils in a school.
AVMOT	Average Motivation	-0.248	0.171	Average Motivation for pupils in a school.
AVEXP	Average Expectation	-0.377	0.158	Average Expectation for pupils in a school.
AVEFF	Average Efficacy	0.202	0.372	Average Efficacy for pupils in a school.
BLACK	Black	0.265	0.441	Black = 1, otherwise = 0
WHITE	White	0.275	0.447	White = 1, otherwise = 0
PRICAN	Puerto Rican	0.082	0.275	Puerto Rican = 1, otherwise = 0
MEXAM	Mexican American	0.147	0.354	Mexican American = 1, otherwise = 0
ORIENTAL	Oriental	0.081	0.273	Oriental = 1, otherwise = 0
AMIND	American Indian	0.081	0.273	American Indian = 1, otherwise = 0
				(The excluded category contains students who respond 'other' and 'neither' to the race and background questions, respectively, and nonresponses.)
NEWENG	New England	0.028	0.165	New England States = 1, otherwise = 0
MIDATL	Mid Atlantic	0.215	0.411	Mid Atlantic States = 1, otherwise = 0
LAKES	Great Lakes	0.149	0.356	Great Lakes States = 1, otherwise = 0
PLAINS	Plains	0.045	0.206	Plains States = 1, otherwise = 0
SEAST	South East	0.215	0.411	South Eastern States = 1, otherwise = 0

Exogenous Variables

Abbreviation	Variable Name	Mean	Standard Deviation	Description
SWEST	South west	0.097	0.295	South Western States = 1, otherwise = 0 (The excluded category contains students from the far west and Rocky Mountain states)
SMSA	Metropolitan Area	1.332	0.471	Within standard metropolitan statistical area = 1, otherwise = 2
SEX	Sex	3.010	0.998	Male = 2, female = 4.
AGE	Age	4.067	0.916	Less than 14 = 1, ... , 20 or older = 7
NOBAS	Number of older brothers and sisters	2.877	2.159	None older = 1, ... , 8 or more older = 9
SES	Socio-economic Status	0.080	2.307	An index constructed from the first principal component of the following standardized variables: father's occupational level (FAOCC), father's and mother's educational level (FAEDD and MOEDD, respectively). Encyclopedia in home (ENCYIH), attended kindergarten and nursery school (KNGTEN and NURSERY, respectively), number of hours work for pay (NHWFPAY), number of people per room in the house (DENSITY). (A high value means a high socio-economic status.)
INFO	Information Available	0.051	1.763	An index constructed from the following standardized variables: dictionary in home (DICTIH), daily newspaper in home (DNEWSIH), trips to library (LIB), number of magazines, and books in home (NMIH and NBIH, respectively). (A high value indicates high availability of information.)
TWOP	Two Parents	0.642	0.479	Two parents alive and living at home = 1, otherwise = 0.
FL	Foreign Language	3.219	1.071	Frequently speak a foreign language out of school = 1, ... , never speak a foreign language = 4
TC	This City	0.755	0.430	Spent most of life in this city or town = 1, otherwise = 0.
RBS	Reading Before School	2.395	1.199	Not read before going to school = 1, ..., regularly read before going to school = 4
PTAS	Parents Talking About School	2.009	1.117	Parents talk about school once a day = 1, ..., parents never or hardly ever talk about school = 4

Exogenous Variables

Abbreviation	Variable Name	Mean	Standard Deviation	Description
NHWTV	Watching Television	3.969	2.119	Not watch TV = 1, ... , 4 hours or more per day = 7.
NHWTV2	(Watching TV)^2	20.244	16.901	
NTCHSCL	Number of times changed school	2.586	1.524	Never changed school = 1, ... , changed school four or more times = 5
LSTCHSCL	Last time changed school	6.004	1.651	Changed school within a year = 2, ... , changed school five or more years ago = 7
TEST	Testing Experience	1.710	0.485	School gives intelligence tests and standardized achievement tests = 2, school gives intelligence or standard achievement tests = 1, otherwise = 0.
PTAAT	Parents attend PTA	1.702	1.024	Parents not go to PTA = 1, ... , parents go most of the time = 4.
NTLKGC	Number of times talk to guidance counselor last year	2.531	1.262	Not talk = 1, ... , talk six or more times = 5.
PWPICLY	Proportion of white pupils in class last year	3.135	1.477	No whites = 1, ... , all white = 5.
MLYBLCK	Mainly black school	0.366	0.482	Less than 30% white = 1, otherwise = 0
MIX	Integrated school	0.101	0.302	30 - 69% white = 1, otherwise = 0
PWTCHLY	Proportion of white teachers in class last year	3.647	1.626	No white teachers = 1, ... , all white teachers = 5.
TAVR	Teachers' average verbal right	29.604	0.394	Teachers' average verbal right for all teachers in the school.
NTPRPUP	Number of teachers per pupil	0.044	0.008	
TPTC	Proportion of teachers from this city.	0.426	0.255	All from this city = 1, ... , none from this city = 0.

Abbreviation	Variable Name	Mean	Standard Deviation	Description
TASEX	Teachers sex	2.924	0.283	All males = 2, ..., All females = 4
TANYTCH	Teachers average number of years teaching	4.430	0.693	No years teaching = 1,..., 30 or more years = 8.
TANYTCH2	(Teachers average number of years teaching)^2	20.108	6.196	
TPADTM	Teachers problems with administration	0.114	0.146	Lack of effective leadership from school administrator = 1,..., no problem = 0.
NTCHLV	Number of teachers who leave	2.152	1.396	Less than 5% left = 1,..., more than 50% left = 7.
AGES	Age of school	4.778	1.757	Main classroom less than one year old = 1,..., more than 39 years old = 7.
PROBLEMS	Problems in the school	167.75	2.389	Constructed from problems of damage, impertinance, discourtesy and violence to teachers racial tension, stealing, drugs and drinking. (High value corresponds to many problems.)
FACILITS	School facilities	12.346	1.799	Principals responses about the school library, auditorium, gymnasium, laboratories, etc. (High value corresponds to many facilities.)
PPRNMADEG	Principal has Master's Degree	4.213	0.642	No degree = 1,..., Doctorate = 6.

APPENDIX II: REDUCED AND STRUCTURAL FORM ESTIMATES OF THE EDUCATIONAL PROCESS MODEL

Dependent Variable	Achievement		Motivation		Expectations	
Explanatory Variable	Reduced Form	Structural Form	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH				0.077 (4.504)		0.063 (5.976)
MOT						0.098 (2.677)
EXP		0.602 (10.152)				
EFF		0.341 (8.910)				
PAEXP^P				0.488 (20.579)		0.230 (9.252)
TEXP^P				0.445 (14.840)		
CONST	1.278 (0.482)		2.164 (1.542)		3.870 (2.851)	1.894 (2.496)
AVACH	0.340 (5.821)	0.228 (5.789)	0.037 (1.202)		-0.038 (-1.279)	
AVMOT	0.600 (3.395)		0.626 (6.696)	0.119 (1.706)	-0.021 (-0.236)	
AVEXP	-0.291 (-1.523)		-0.314 (-3.107)		0.596 (6.099)	0.474 (7.414)
AVEFF	-0.088 (-1.094)		-0.001 (-0.019)		0.024 (0.570)	
BLACK	-0.724 (-7.030)	-1.145 (-12.429)	0.678 (12.443)	0.283 (5.409)	0.254 (4.825)	0.102 (2.872)
WHITE	1.228 (11.849)	0.844 (8.355)	0.238 (4.339)		0.101 (1.906)	
PRICAN	-0.940 (-7.737)	-0.930 (-8.412)	0.056 (0.865)	0.111 (1.802)	-0.017 (-0.271)	
MEXAM	-1.011 (-9.542)	-0.963 (-9.897)	0.009 (0.153)	0.145 (2.785)	-0.134 (-2.467)	
ORIENTAL	1.489 (12.338)	1.219 (10.908)	0.471 (7.378)	0.223 (4.107)	0.363 (5.883)	0.191 (4.283)
AMIND	-0.409 (-3.387)	-0.468 (-4.218)	0.228 (3.566)	0.218 (4.042)	0.118 (1.908)	0.119 (2.982)
NEWENG	-0.022 (-0.143)		-0.269 (-3.369)		-0.172 (-2.228)	
MIDATL	0.067 (0.721)		-0.148 (-3.024)		-0.169 (-3.571)	-0.157 (-5.524)
LAKES	-0.013 (-0.156)		-0.147 (-3.373)		-0.199 (-4.710)	-0.151 (-4.631)
PLAINS	0.879 (7.363)	0.552 (5.219)	-0.016 (-0.247)		0.089 (1.455)	
SEAST	-0.438 (-4.686)	-0.741 (-10.180)	0.372 (7.516)	0.155 (3.836)	0.011 (0.240)	-0.077 (-2.370)
SWEST	-0.304 (-3.194)	-0.524 (-6.518)	0.487 (9.668)	0.238 (5.246)	0.167 (3.429)	
SMSA	-0.136 (-2.169)	-0.341 (-6.037)	0.114 (3.438)		0.014 (0.447)	
SEX	-0.218 (-9.637)	-0.270 (-10.970)	0.038 (3.139)	0.206 (16.062)	-0.079 (-6.826)	
AGE	-0.300 (-11.740)	-0.141 (-5.714)	-0.156 (-11.568)		-0.113 (-8.636)	-0.046 (-3.624)
NOBAS	-0.108 (-9.873)	-0.080 (-7.738)	-0.039 (-6.701)		-0.027 (-4.830)	
SES	0.290 (22.869)		0.078 (11.650)	-0.077 (-7.430)	0.172 (26.484)	0.097 (11.768)

	Achievement (cont.)		Motivation (cont.)		Expectations (cont.)	
	RF	S.F.	R.F.	S.F.	R.F.	S.F.
INFO	0.139 (8.770)	0.036 (2.160)	0.151 (17.961)	0.022 (2.151)	0.121 (14.905)	0.056 (6.425)
TWOP	0.138 (2.797)	0.077 (1.706)	0.075 (2.884)		0.041 (1.616)	
FL	-0.118 (-4.961)		-0.077 (-6.121)	0.030 (2.308)	-0.138 (-11.353)	-0.091 (-8.654)
TC	0.052 (0.924)		0.077 (2.562)	0.078 (2.695)	-0.068 (-2.336)	-0.071 (-2.765)
RBS	0.092 (4.517)		0.088 (8.158)		0.068 (6.477)	0.028 (2.880)
PTAS	0.159 (7.349)		-0.163 (-14.177)		-0.079 (-7.155)	
NHWTV	0.203 (4.087)		0.189 (7.128)	0.180 (6.723)	0.099 (3.923)	0.063 (2.696)
NHWTV2	-0.034 (-5.438)		-0.035 (-10.599)	-0.026 (-7.601)	-0.020 (-6.367)	-0.011 (-3.708)
NTCHSCL	0.023 (1.362)		-0.006 (-0.679)		-0.024 (-2.799)	-0.027 (-3.659)
LSTCHSCL	0.107 (6.988)	0.026 (1.931)	0.104 (12.738)	0.065 (8.331)	0.035 (4.469)	
TEST	0.354 (6.574)	0.363 (7.621)	-0.151 (-5.302)		-0.022 (-0.791)	
PTAAT	-0.138 (-5.890)		0.[illegible]65 (5.260)		0.092 (7.659)	0.075 (6.756)
NTLKGC	0.240 (12.860)		0.123 (12.428)		0.178 (18.586)	0.125 (13.449)
PWPICLY	0.054 (1.964)	0.087 (3.370)	-0.005 (-0.321)	0.033 (2.233)	-0.051 (-3.638)	-0.058 (-5.397)
MLYBLCK	-0.990 (-12.928)	-0.871 (-12.303)	0.440 (10.867)	0.340 (7.955)	-0.043 (-1.097)	-0.070 (-2.070)
MIX	-0.539 (-5.968)	-0.557 (-6.905)	0.228 (4.778)	0.154 (3.273)	0.058 (1.244)	
PWTCHLY	0.076 (3.178)	0.040 (1.825)	0.102 (8.056)	0.064 (5.076)	0.014 (1.183)	
TAVR	0.258 (4.144)	0.258 (6.235)	-0.057 (-1.724)		-0.024 (-0.768)	
NTPRPUP	8.695 (2.763)	12.574 (4.654)	-1.010 (-0.607)		-4.317 (-2.681)	
TPTC	-0.190 (-1.399)		0.048 (0.669)		-0.034 (-0.492)	
TASEX	0.121 (1.292)	0.220 (2.614)	-0.018 (-0.368)		0.029 (0.595)	
TANYTCH	-1.400 (-4.756)	-0.875 (-3.319)	-0.202 (-1.299)		-0.205 (-1.361)	
TANYTCH2	0.178 (5.387)	0.106 (3.590)	0.029 (1.654)		0.031 (1.818)	
TPADTN	0.736 (4.495)	0.646 (4.347)	0.103 (1.195)		0.063 (0.752)	
NTCHLV	0.062 (3.449)	0.044 (2.713)	0.005 (0.573)		0.011 (1.148)	
AGES	0.013 (0.872)		-0.003 (-0.363)	0.019 (2.547)	-0.007 (-0.870)	
PROBLEMS	-0.040 (-3.933)	-0.037 (-5.206)	-0.004 (-0.806)		-0.013 (-2.410)	-0.010 (-2.194)
FACILITS	0.036 (2.564)	0.044 (3.443)	-0.022 (-2.968)	-0.016 (-2.344)	-0.005 (-0.689)	
PRNMADEG	-0.125 (-3.347)		-0.015 (-0.770)		0.056 (2.958)	0.056 (3.428)
MLR^2	0.4078	0.5377	0.2645	0.5910	0.2507	0.3966
ALTR^2	0.4078	0.3964	0.2645	0.2620	0.2507	0.2495

Dependent Variable	Efficacy		Perceived Parents Expectations		Perceived Teachers Expectations	
Explanatory Variables	Reduced Form	Structural Form	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH		0.219 (6.903)				
MOT				0.485 (8.443)		
EXP				0.402 (6.034)		0.481 (14.757)
EFF						0.098 (6.967)
PAEXP^p						
TEXP^p		0.615 (5.909)		0.546 (6.201)		
CONST	-7.446 (-2.441)		3.546 (1.900)	3.903 (8.657)	-4.431 (-3.047)	-4.720 (-12.143)
AVACH	-0.325 (-4.830)		-0.028 (-0.690)		-0.043 (-1.327)	
AVMOT	0.065 (0.319)		0.417 (3.358)		0.094 (0.974)	
AVEXP	-0.179 (-0.813)		0.038 (0.280)		0.721 (0.688)	
AVEFF	0.955 (10.280)	0.524 (8.102)	0.026 (0.453)		0.129 (2.921)	
BLACK	0.251 (2.117	0.301 (4.153)	0.716 (9.882)	0.199 (4.377)	0.148 (2.625)	0.072 (2.194)
WHITE	0.941 (7.891)	0.584 (6.255)	0.100 (1.367)	-0.124 (-3.119)	0.125 (2.203)	
PRICAN	-0.278 (-1.988)		0.085 (0.991)	0.133 (2.294)	-0.109 (-1.638)	
MEXAM	-0.173 (-1.420)		-0.077 (-1.039)		-0.098 (-1.693)	
ORIENTAL	0.271 (1.947)		0.367 (4.318)		-0.083 (-1.250)	-0.295 (-5.667)
AMIND	-0.129 (-0.931)		0.084 (0.990)		-0.018 (-0.272)	
NEWENG	0.128 (0.738)		-0.472 (-4.445)	-0.240 (-2.691)	-0.022 (-0.271)	
MIDATL	0.430 (4.052)		-0.148 (-2.284)		0.008 (0.159)	0.073 (1.695)
LAKES	0.151 (1.591)		-0.157 (-2.709)	-0.135 (-1.915)	0.028 (0.609)	0.108 (2.623)
PLAINS	0.892 (6.497)	0.497 (4.216)	-0.047 (-0.557)		0.101 (1.542)	
SEAST	0.309 (2.876)		0.374 (5.683)		0.339 (6.616)	0.313 (7.475)
SWEST	0.305 (2.790)		0.478 (7.141)		0.278 (5.317)	0.185 (4.032)
SMSA	0.354 (4.900)	0.381 (6.622)	-0.009 (-0.204)	-0.143 (-3.846)	0.096 (2.794)	
SEX	0.241 (9.290)	0.296 (11.772)	-0.296 (-18.629)	-0.270 (-17.135)	-0.017 (-1.365)	
AGE	-0.279 (-9.490)	-0.154 (-4.673)	-0.146 (-8.135)	0.034 (1.954)	-0.100 (-7.146)	
NOBAS	-0.065 (-5.131)	-0.041 (-3.380)	-0.050 (-6.442)	-0.020 (-2.639)	0.0002 (0.034)	0.021 (3.480)
SES	0.162 (11.146)	0.064 (3.370)	0.218 (24.489)	0.085 (6.653)	0.054 (7.775)	-0.045 (-5.024)
INFO	0.129 (7.092)	0.049 (2.439)	0.176 (15.740)		0.072 (8.279)	

	Efficacy (cont.)		Parents' Expectations (cont.)		Teachers'Expectations(cont.)	
	R.F.	S.F.	R.F.	S.F.	R.F.	S.F.
TWOP	0.041 (0.717)		0.253 (7.275)	0.212 (6.485)	-0.024 (-0.898)	
FL	-0.012 (-0.454)	0.066 (2.560)	-0.137 (-8.168)		-0.067 (-5.177)	
TC	0.017 (0.254)		-0.017 (-0.434)		0.019 (0.624)	
RBS	0.217 (9.269)	0.159 (7.022)	0.108 (7.558)		0.065 (5.846)	
PTAS	0.029 (1.161)		-0.330 (-21.648)	-0.199 (-13.003)	-0.041 (-3.464)	
NHWTV	0.251 (4.404)		0.019 (0.555)		-0.039 (-1.427)	
NHWTV2	-0.039 (-5.470)		-0.014 (-3.193)		0.0002 (0.056)	
NTCHSCL	-0.021 (-1.065)		0.005 (0.426)	0.022 (2.031)	-0.002 (-0.199)	
LSTCHSCL	0.130 (7.354)	0.104 (6.819)	0.047 (4.376)	-0.033 (-3.084)	0.026 (3.027)	
TEST	0.057 (0.914)		-0.179 (-4.722)		-0.096 (-3.235)	
PTAAT	-0.057 (-2.128)		0.080 (4.837)		0.045 (3.521)	
NTLKGC	0.476 (22.181)	0.337 (12.371)	0.099 (7.539)	-0.106 (-6.712)	0.141 (13.807)	
PWPICLY	0.026 (0.804)		-0.047 (-2.444)		0.044 (-2.934)	
MLYBLCK	-0.341 (-3.874)	-0.298 (-4.201)	0.246 (4.572)		0.170 (4.045)	0.278 (7.890)
MIX	-0.194 (-1.864)	-0.203 (-2.356)	0.095 (1.499)		0.107 (2.151)	0.136 (2.926)
PWTCHLY	0.098 (3.581)	0.099 (4.836)	0.063 (3.741)		0.005 (0.376)	
TAVR	0.162 (2.263)		-0.071 (-1.614)		0.008 (0.239)	
NTPRPUP	-10.382 (-2.869)		-6.679 (-3.017)	-4.279 (-2.392)	-0.755 (-0.438)	
TPTC	-0.219 (-1.397)		0.014 (0.147)		0.112 (1.504)	0.170 (2.562)
TASEX	-0.126 (-1.162)		0.098 (1.477)	0.118 (2.199)	-0.093 (-1.812)	-0.098 (-1.970)
TANYTCH	-1.073 (-3.171)	-0.457 (-2.016)	-0.188 (-0.906)		0.103 (0.635)	0.347 (2.199)
TANYTCH2	0.148 (3.900)	0.065 (2.458)	0.027 (1.143)		-0.004 (-0.233)	-0.039 (-2.169)
TPADTN	0.131 (0.695)		-0.052 (-0.452)		-0.253 (-2.815)	-0.240 (-2.783)
NTCHLV	0.056 (2.695)		-0.001 (-0.111)		0.018 (1.768)	
AGES	-0.021 (-1.203)		-0.038 (-3.521)	-0.030 (-3.383)	-0.020 (-2.323)	-0.019 (-2.374)
PROBLEMS	0.011 (0.954)		0.005 (0.657)		0.001 (0.253)	
FACILITS	-0.006 (-0.363)		-0.017 (-1.692)		-0.022 (-2.918)	-0.022 (-3.017)
PRNMADEG	-0.034 (-0.802)		0.055 (2.117)		0.012 (0.606)	
MLR^2	0.1935	0.3125	0.2764	0.5557	0.0846	0.2260
$ALTR^2$	0.1935	0.1886	0.2764	0.2752	0.0846	0.0814

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EDUCATION FROM AN ANTHROPOLOGICAL PERSPECTIVE: AN EMPIRICAL INVESTIGATION OF STRUCTURAL DIFFERENCES AMONG BLACKS AND WHITES

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EDUCATION FROM AN ANTHROPOLOGICAL PERSPECTIVE:AN EMPIRICAL INVESTIGATION OF STRUCTURAL DIFFERENCES AMONG BLACKS AND WHITES

I. Introduction:

This paper introduces anthropologists to simultaneous equations models and to a powerful technique for estimating such models. Characteristically a simultaneous equations model consists of more than one equation and allows for interaction and joint determinancies between some of the variables. Basically these models apply to situations in which one variable depends on another variable which in turn depends on the first variable. These formulations model feedbacks.

Originally statisticians developed simultaneous equations estimation techniques for estimating economic models and for prediction in economics, but, more recently, sociologists, political scientists, educators and other quantitative social scientists have applied the technique to research in their own areas. The authors believe that anthropologists can model much of their research with simultaneous equations. By estimating these models anthropologist will have far greater insight than they would gain by any other research technique.

To demonstrate the use of simultaneous equations models in the social sciences, we draw upon our research in the area of education. Since the publication of the Equality of Educational Opportunity Report, EEOR [ ], often called the Coleman report, many authors have modelled the educational process. The EEOR acted as a watershed for research in education. Much of the recent interest in this area stems from the controversial nature of the conclusions of the report. Section II of this paper concerns the methodology and results of the report. Although the EEO survey data has been subjected to countless reanalyses including those by the Civil Rights Commission and the work, On Equality of Educational Opportunity, OEOEO [ ], most of the research affirms the original conclusions. The primary reason for the similar results stem from the methodology used in the reanalyses which more or less duplicated the tecnique used in the EEOR. Most of the reanalyses model the educational process by a single equation educational production function. Only Levin [ ] allows for feedback effects and he utilizes a limited subsample in addition to making methodological errors.

Section III of this paper argues that the single equation models are inappropriate formulations of the educational process. We argue that simultaneous equations should model the process. If the construction and estimation of a simultaneous equations model succeeds, then the results of estimating the model by a single equation may be biased and inconsistent. Consistency is an important property of an estimator. It means that as the sample size increases, the coefficient estimates tend to the true parameter values. Using the EEOS data, the estimates for the simultaneous equations model for Blacks and Whites are presented in Section IV. Finally we show that these results differ from those obtained previously.

II. The EEOR and Single Equation Models of the Educational Process:

Most models of the educational process have the following general form:

$$Ai = \beta_o + \beta_B \beta_i + \beta_H H_i + \beta_P P_i + \beta_S S_i + \beta_T T_i + e_i \quad i=1,2,\ldots\ldots,N \quad \text{(Eqn. 1)}$$

where Ai = achievement score of student i

Bi = a set of attitudes and beliefs held by student i about himself

Hi = a set of home background characteristics of student i

Pi = a set of student body and peer group influences on student i

Si = a set of school characteristics which influence student i

Ti = a set of teacher characteristics for student i

e_i = an error term for student i

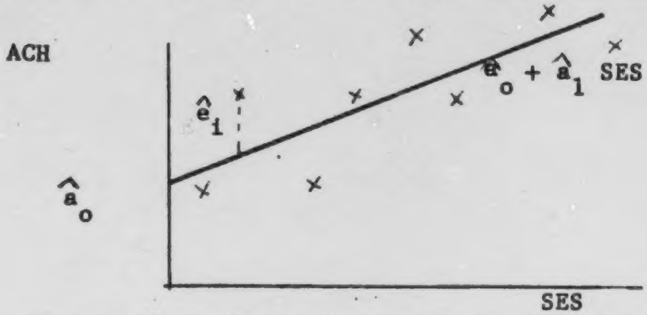
N = number of students

β_o, β_B, β_H, β_P, β_S, β_T denote parameters or vectors of parameters of appropriate dimension.

Econometicians call this model a simple regression model and they refer to the parameters as regression coefficients. Each coefficient of a variable measures the marginal increase in achievement per unit increase in that particular variable. A parameter estimate gives the expected increase in the dependent variable per unit increase in an explanatory variable. One may use all the estimated parameters and observations on all the explanatory variables to arrive at a predicted value of the dependent variable. Various techniques may estimate the parameters. Often econometricians use the technique of ordinary least squares. This method finds the line which minimises the sum over all observations of the squared differences between the actual observed value of the dependent variable and the predicted value of the dependent variable.[1] We may illustrate this technique graphically in the two dimensional case. Suppose that socioeconomic status, SES, influences achievement:

$$ACH_i = a_o + a_1 SES_i + e_i \qquad i = 1,2,\ldots,N$$

We regress achievement on socioeconomic status and derive the ordinary least squares estimates of a_o and a_1 which we denote by $\hat{a}_o$ and $\hat{a}_1$, respectively. We may plot the regression line and the data:



$\hat{a}_o$ measures where the estimated regression line meets the achievement axis. $\hat{a}_1$ indicates the slope of the regression line. Ordinary least squares calculates the parameters to minimise the sum of the squared differences denoted by $\hat{e}_i$, that is, the vertical distance between each observation and the regression line. While the above example considers only a single explanatory variable, exactly the same principles apply in more general cases, such as the model given by eqn. 1.

Economists concerned with education call the above model (eqn.1)an educational production function. The dependent variable, achievement, is explained by a set of individual, home, and school characteristics. The EEOR implicitly uses the above model. In order to determine the importance of an explanatory variable, the authors of the EEOR use a technique called stepwise regression where the criterion for the entry of additional variables into the regression may depend upon which of these variables add more to the R^2. The R^2, called the coefficient of determination, equals the square of the multiple correlation coefficient.

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1. See Johnston [ ] for an excellent introductory text on econometrics.

It measures the goodness of fit. The higher the R^2 $(0 \leq R^2 \leq 1)$, the more the independent variables explain the variance in the dependent variable.

Suppose that a regression model has k explanatory variables and one wants to determine the contribution of the kth variable to the goodness of fit. The researcher performs two regressions. The first consists of regressing the dependent variable on the first k - 1 explanatory variables. The second consists of regressing the dependent variable on all k explanatory variables. The difference in the R^2 (which must be higher for the second regression) is the contribution of the kth variable to the explained variance of the dependent variable.

Using this technique, the authors of the EEOR find that after including home background characteristics in the model, adding variables measuring school characteristics do not greatly increase the R^2. Putting this another way, one may say that differences between schools account for only a small fraction of the difference in pupil achievement whereas differences between families tend to account for differences in achievement. Of all the school variables the characteristics of a pupil's peer group add most to the R^2. After adding these variables to the regression, teacher characteristics add more to the R^2 than any other school attributes. Controversially, Coleman [ ] says, "Other resources, on which school systems spend much money, appear unimportant." These results combined with the finding that school facilities differ little in quantity from school to school suggest that the school can do little to overcome the differences between pupils associated with race and home background.

III: A Simultaneous Equations Model of the Educational Process:

Numerous authors have criticized the methodology of the EEOR. The most fundamental of these criticisms concerned the use of addition to R^2 as a measure of the importance of a variable. As Cain and Watts [ ] said, "When we have such a model in the form of a regression equation, the regression coefficient is our most useful statistic measuring the important of a variable for the purpose of policy action." The authors of the EEOR did not report the regression coefficients. Not surprisingly, numerous authors have reanalyzed the data using ordinary least squares which estimates regression coefficients. In OEOEO, Marshall Smith performed one of the most careful regression analyses. He concluded, however, "In general, the results of the reexamination affirm and strengthen the overall conclusions of the [EEO] report." Virtually all of the reanalyses reported similar findings.

Few researchers critically question the modelling of the EEOR. Of all the variables in the survey, the EEOR finds that a pupil's belief in his ability to control the environment and his self-concept show the greatest relation to achievement. Our research defines efficacy (EFF) as a linear combination of self-concept and control of the environment. Thus, we may write:

EFF -> ACH

But, as Mosteller and Moynihan point out in OEOEO, "could not such feelings of control be essentially a feedback reaction from reality? Bright students who got good marks might feel good about themselves." That is, achievement feeds back to efficacy:

EFF <- ACH.

This arguement has obvious intuitive appeal. To ignore it means that the model may be misspecified. If there is a feedback from achievement to efficacy the single equation educational production function, equation 1, is a misspecified model. In this situation the error term correlates with the explanatory variable, efficacy. This violates one of the usual assumptions of the regression model and application of ordinary least squares may result in biased and inconsistent estimates of the parameters. Econometricians refer to this situation as simultaneous equations bias. It means that however large a sample one takes, the estimated regression coefficients do not approach the true values of those parameters. Depending upon the nature of the bias applying single equation estimation procedures to simultaneous equations models may overestimate or underestimate the regression coefficient of a variable[1/] which, in turn, may lead to erroneous policy inferences and decisions.

In addition to the feedback relationships between efficacy and achievement we postulate that a pupil's achievement, motivation, efficacy, expectations and his perceived teachers' and parents' expectations jointly determine one another. Econometricians call these variables endogenous because their values are generated within the system.

When specifying a model one should make use of all the available, relevant information. We argue above that efficacy and achievement reinforce one another. We may expect the same relationship between pupils expectations

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[1/] See Johnston [ ] p. 233-234 .

and achievements. A student who expects to succeed may perform better than one who does not expect to succeed. Obviously the converse relationship also holds. Among other things, a student bases his expectations on his past performance.

While we postulate feedback effects between many of the variables, we do not require complete simultaneity nor do we expect it. We may suppose that a pupil expects more the harder he works. Thus, motivation should affect expectations. Now for the opposite causal link: students who expect to do well may or may not work harder as a result of these higher expectations. A pupil with low expectations may say to himself something like, " I doubt if I'll ever be any good so why bother to work", or alternatively, " I doubt, if I'll ever be any good, but the only way to succeed is to work." In short, no obvious causal link goes for expectations to motivation.

Often one does not have sufficient prior information to completely specify the model. One may be uncertain about whether there is a causal effect from one variable to another. But this fact does not act as a stumbling block. If we are certain of all the causal relations, there would be no point in going to the data. Nobody can specify a model of the educational process with complete accuracy. The important point is to include as much theoretical background and common sense as possible. Without going into any more detail, we specify the following causal relationships between the endogenous variables:

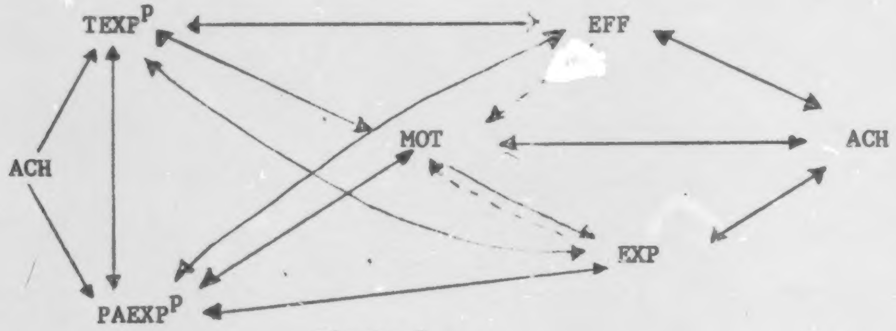

Figure 1.

Where, ACH = Pupil achievement

MOT = Pupil motivation

EFF = Pupil efficacy

EXP = Pupil expectation

$TEXP^P$ = Pupil's perception of his teachers' expectations

$PAEXP^P$ = Pupil's perception of his parents' expectations

Solid lines indicate student a priori causality, while the dotted lines indicate teacher a priori causality. The arrows indicate causal directions. Psychologists may call this model phenomenological because of the importance attached to self perceptions.

The above figure summarizes the postulated causal relations between the endogenous variables. To completely specify the model, one needs to postulate the effect each exogenous variable on each endogenous variable. An exogenous variable is generated outside the system. A pupil's number of older brothers and sisters is a good example of an exogenous variable. Nothing that a pupil does can affect it. It is fixed. We do not specify the relationships between each exogenous variable and each endogenous variable here, due to space constraints. A complete list of the exogenous variables appears in appendix I.

IV. The Results and Two Stage Least Squares

IV. I Introduction:

Appendix II contains the parameter estimates of the model outlined in the previous section. Before discussing these results we shall consider their derivation. An econometric technique called two stage least squares estimates the parameters of the model. To provide an example of how the method works consider the following two equations model:

$$ACH_i = a_o + a_1\ EFF_i + a_2\ SEX_i + a_3\ NTPRPUP_i + e_{1i} \quad (i = 1,2,\ldots,N) \quad \text{eqn. } 2$$

$$EFF_i = b_o + b_1\ ACH_i + b_2\ SEX_i + b_3\ FL_i + \quad e_{2i} \quad (i = 1,2,\ldots,N) \quad \text{eqn. } 3$$

In the first equation of this model efficacy, sex, and the number of teachers per pupil directly influence pupil achievement. In the second equation achievement, sex, and how often a pupil speaks a foreign language, FL, directly influence pupil efficacy.[1/] One may well think that this model is unreasonable, but it exemplifies the purpose. Econometricians call eqns (2) and (3) the structural form of the model. The structural form represents an approximation of how we think achievement and efficacy are determined in the real world.

We may derive another form of the model in the following way. Substitute eqn. (3) into eqn. (2) and obtain:

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1. We postulate that the number of teachers per pupil has not direct influence on efficacy, and speaking a foreign language has no direct influence on achievement. Each equation excludes one of the exogenous variables. Thus, the model is identified a priori, that is, the structural form parameters may be estimated from the data. Christ [ ] provides a good elementary discussion of the identification problem. Fisher [ ] and Koopmans [ ] discuss the problem with skill and rigor at an advanced level.

$$ACH_i = a_o + a_1 (b_o + b_1 ACH_i + b_2 SEX_i + b_3 FL_i + e_{2i})$$

$$+ a_2 SEX_i + a_3 NTPRPUP_i + e_{1i} \qquad (i = 1,2,\ldots,N)$$

or,

$$ACH_i = \tilde{\pi}_{10} + \tilde{\pi}_{11} SEX_i + \tilde{\pi}_{12} NTPRPUP_i + \tilde{\pi}_{13} FL_i + V_{1i} \qquad (i = 1,2,\ldots N) \text{ eqn.4}$$

where $\tilde{\pi}_{10} = \dfrac{a_o + a_1 b_o}{1 - a_1 b_1}$ $\qquad \tilde{\pi}_{11} = \dfrac{a_1 b_2 + a_2}{1 - a_1 b_1}$

$$\tilde{\pi}_{12} = \frac{a_3}{1 - a_1 b_1} \qquad \tilde{\pi}_{13} = \frac{a_1 b_3}{1 - a_1 b_1} \qquad v_{1i} = \frac{e_{1i} + a_1 e_{2i}}{1 - a_1 b_1}$$

Substitute eqn. (2) into eqn. (3) and rearrange to obtain:

$$EFF_i = \tilde{\pi}_{20} + \tilde{\pi}_{21} SEX_i + \tilde{\pi}_{22} NTPRPUP_i + \tilde{\pi}_{23} FL_i + v_{2i} \qquad (i = 1,2,\ldots,N) \text{ eqn. 5}$$

where $\tilde{\pi}_{20} = \dfrac{b_o + b_1 a_o}{1 - a_1 b_1}$ $\qquad \tilde{\pi}_{21} = \dfrac{b_2 + b_1 a_2}{1 - a_1 b_1}$

$$\tilde{\pi}_{22} = \frac{b_1 b_3}{1 - a_1 b_1} \qquad \tilde{\pi}_{23} = \frac{b_3}{1 - a_1 b_1} \qquad v_{2i} = \frac{e_{2i} + b_1 e_{1i}}{1 - a_1 b_1}$$

Equations (4) and (5) constitute the reduced form of the model given by equations (2) and (3). Each endogenous variable is a function of all the exogenous variables in the model.

As the name suggests two stage least squares has two distinct steps. At the first stage it estimates the reduced form parameters, the $\tilde{\pi}_{ij}$'s, by ordinary least squares. It regresses achievement on sex, the number of teachers per pupil and foreign language, and obtains estimates of $\tilde{\pi}_{10}$, $\tilde{\pi}_{11}$, $\tilde{\pi}_{12}$, and $\tilde{\pi}_{13}$ which we denote by $\hat{\pi}_{10}$, $\hat{\tilde{\pi}}_{11}$, $\hat{\tilde{\pi}}_{12}$, and $\hat{\tilde{\pi}}_{13}$, respectively.

We call these estimated parameters reduced form coefficient estimates. They measure the total effect of an exogenous variable on an endogenous variable. The reduced form coefficient estimate $\tilde{\pi}_{11}$ measures the direct effect of sex on achievement plus the indirect effect which sex exerts on efficacy which, in turn, affects achievement. In most circumstances, policy makers wish to know the total effect of an explanatory variable on a dependent variable. They want the reduced form coefficients.

By multiplying each observed exogenous variable by its associated estimated parameter we obtain a predicted value for pupil achievement, denoted ACH:

$$\widehat{ACH}_i = \hat{\tilde{\pi}}_{10} + \hat{\tilde{\pi}}_{11} SEX_i + \hat{\tilde{\pi}}_{12}\, NTPRPUP_i + \hat{\tilde{\pi}}_{13} FL_i \qquad (i = 1,2,..,N) \text{ eqn. 6}$$

Similarly, we may obtain the predicted values of efficacy:

$$\widehat{EFF}_i = \hat{\tilde{\pi}}_{20} + \hat{\tilde{\pi}}_{21}\, SEX_i + \hat{\tilde{\pi}}_{22}\, NTPRPUP_i + \hat{\tilde{\pi}}_{23} FL_i \qquad (i = 1,2,...,N) \text{ eqn.7}$$

We now estimate the structure; this is the second stage. We regress achievement on the value of efficacy predicted by eqn. (7), sex, and the number of teachers per pupil. That is, we regress achievement on the predicted endogenous variable and only the exogenous variables which appear in the structural form equation (eqn.2). Similarly we regress efficacy on achievement predicted from eqn.6, sex and foreign language. Thus we obtain parameter estimates of the structural form of the model which are consistent.

Appendix II contains the estimated parameters of both the reduced form and the structural form for blacks and whites. There are six equations, one for each endogenous variable. Each cell contains the estimated coefficient and the t-statistic in parenthesis. The t-statistic measures the significance of the coefficient. A t-statistic of 1.645 means the probability that the coefficient is less than or equal to zero equals 0.05 (for a one tailed test). A t-statistic of 1.96 means the probability that the coefficient is less than or equal to zero equals 0.025.(for a one tailed test).

The data come from the EEOS data for twelfth grade pupils. Our research combines these data with information on the individual pupil's teachers and principals. The actual samples consist of 4530 White pupils and 4364 Black pupils who are randomly selected in proportion to the region of the country and the size of the school. These data are carefully refined and missing values are recoded whenever necessary. While time series data would have been best, no data exist which contain anything more than a small fraction of the information on the EEOS questionaires. Numerous authors including Jencks [ ], Bowles and Levin [ ], and Cain and Watts [ ] have analyzed or criticized the data,but none of their criticisms necessitate rejecting the data. Appendix I contains a description of the variables used in our analysis and the mean and standard deviation of each variable.

4.1. Findings for the Endogenous Variables:

While the estimated models for Blacks and Whites do not correspond exactly to what we thought to be the case on an a priori basis, the estimated structures do conform generally to what we expected. Figures 2 and 3 summarize the estimated relationships between the endogenous variables for Blacks and Whites respectively. The authors require that the level of significance for endogenous variables to exceed the 0.05 level for the relationship to be reported. The striking feature about Figures 2 and 3 is their basic similarity. For both Blacks and Whites, individual motivation, expectations, efficacy, and percieved parent's and teacher's expectations influence pupil achievement; but all the variables do not influence achievement directly. Only individual expectations and efficacy have a direct effect, and this finding holds for both groups.

For both Blacks and Whites the significant effect of individual efficacy suggests that increased learning takes place when students have confidence in their own ability and feel that the "environment" is not against them. One particularly interesting chain relationship is the influence of percieved teacher's expectations on individual efficacy which, in turn, affects achievement. This chain suggests that teachers can have an effect upon achievement by teaching students to have confidence in themselves and their ability to succeed.

For both Blacks and Whites pupil's expectations is the only other variable directly affecting achievement after excluding influences which are insignificant at the 0.05 level. Many of the effects of the endogeneous variables upon achievement operate indirectly through their effects upon student's expectations.

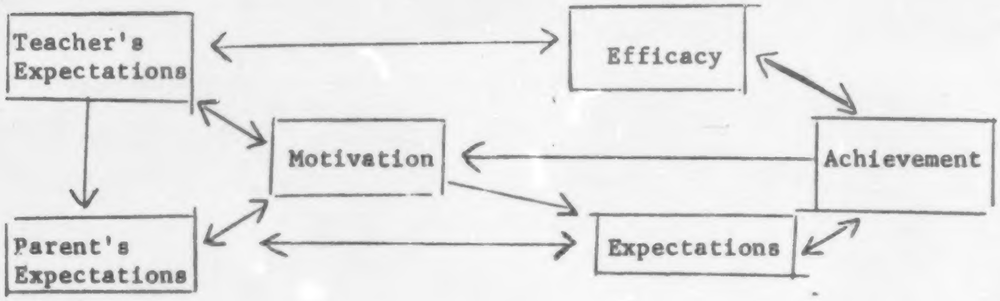
Teacher's Expectations
Efficacy
Motivation
Achievement
Parent's Expectations
Expectations

Figure 2 Summary of the Endogenous Structure for Blacks

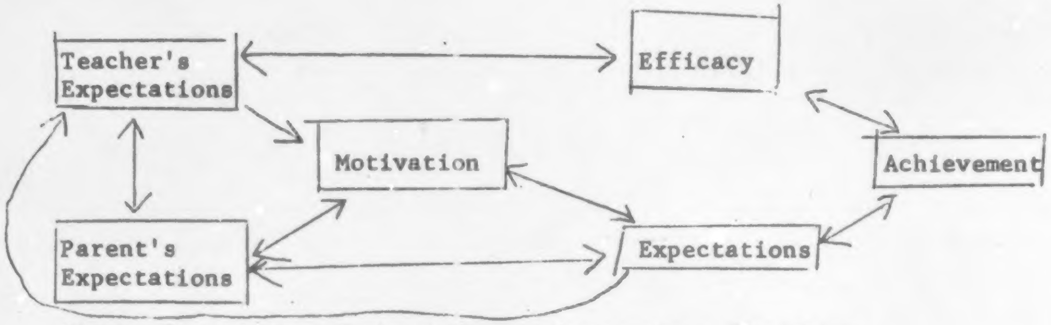
Teacher's Expectations
Efficacy
Motivation
Achievement
Parent's Expectations
Expectations

Figure 3 Summary of the Endogenous Structure for Whites

Motivation and parents' expectations do not have a significant direct effect upon achievement, but they exert indirect influences by their positive effects upon students' expectations. Strong motivation leads students to expect to do well and this increased expectation leads to improved performance.

For both Blacks and Whites pupil's perception of his parents' expectations of his achievement both affects and is affected by his own expectations. If a student expects success then he is more likely to perceive that his parents expect him to perform well, and this perception in turn leads to an increased individual expectation of his ability to achieve. This increased individual expectation leads to improved performance.

Parents' expectations has this idrect effect upon a student's own expectations, and also an indirect effect via motivation. In other words, if a student perceives high parental expectations, then these expectations motivate him to fulfill these aspirations.

Contrary to what might have been thought a priori,a Black or White student's perception of his parents' aspirations for his achievement is not directly affected by his academic performance. Instead, this perception is related to his individual expectations and motivation. On the other hand, one of the interesting differences between Blacks and Whites is the finding that perceived parents' expectations both affect and are affected by perceived teachers' expectations for Whites, while Black students' perceptions of their parents' expectations for them are affected by their perception of their teachers' expectations, but here the relationship is not mutual.

A Black or White student's perception of his teachers' expectations does not depend directly upon his own academic performance. For Whites this perception depends on his own expectations concerning his ability to achieve and his own self confidence. For Blacks this perception does not appear to depend upon his own expectations, but it depends instead upon his efficacy and his motivation. Both a Black and a White student's own expectations are not directly influenced by his perception of his teachers' expectations. The teachers' expectations have only indirect influences by affecting efficacy, motivation and the student's perception of his parents' expectations. For both Blacks and Whites, parents' expectations and his own motivation affect his own expectations which in turn influence achievement. This interrelated chain of influences suggests that teachers have an important indirect effect upon their students' academic performance, no matter what the student's race. Among the endogenous variables for both races, the teachers' influence appears to be largely that of shaping attitudes, instilling confidence in the students, motivating them,and affecting their belief about whether there is a reward for hard work and whether effort, rather than luck, might be the most important ingredient in determining their destiny.

This evidence indicates that among the endogenous variables for both races, motivation depends primarily upon students' perception of the expectations which parents and teachers have for their academic performance. While a Black student's own achievement has an important positive feedback to his motivation, there appears to be no such feedback from achievement for White students. Similarly, a White student's motivation does not appear to affect his perception of his teachers' expectations for him, but a Black student's motivation does exert a positive influence upon his teachers' expectations. All these results serve to highlight the roles for both races which teachers and parents play in motivating students by simply getting them to perceive that they are expected to achieve.

Finally, one should note that not only is achievement directly influenced by expectations and efficacy, but these variables are also affected by achievement and this finding obtains for both races. Hence students who perform well are likely to have relatively high expectations and are more likely to have confidence in their ability to succeed. These variables, in turn, contribute to performance. This evidence tends to confirm the old idea that success breeds success, and it is not dependent upon race for its veracity.

IV.III Findings for the Exogenous Variables:

This sub-section considers the influence of the exogenous variables. Although the achievement equation is emphasized, all equations are considered as the discussion proceeds to various groups of exogenous variables.

IV.III.I Region, Race and Individual Demographic Characteristics:

At least since the Coleman Report, a great deal of interest has focused upon the difference in educational achievement between the races. Our results document the fact that there are substantial differences between Blacks and Whites. Indeed, the two means of the achievement indices are approximately a standard deviation apart. Note in the achievement equation for Whites that there is an exceptionally large and significant constant term while that term in the Black's achievement equation was not significantly different from zero. Whatever race indicates, it obviously relates importantly to educational achievement.

The racial results for the other endogenous variables may be somewhat surprising. The means for the two groups which are reported in Appendix I tell a large part of the story. On the average Blacks have higher motivation, expectations, and perceive that their parents have higher expectations for them than do Whites. While they are lower in efficacy, both groups are about equal in terms of the expectations which they perceive that their teachers have for them. Obviously, something in the educational system or the culture has resulted in an advantage for Black students in terms of these variables, but nevertheless on the average Black achievement lags behind that of Whites.

The use of dummy variables for the various regions of the United States represents an attempt to take into account the possibility that educational systems and processes may differ importantly across the country. The most significant finding is that those regional coefficients which are significantly different from zero have the same sign for both Blacks and Whites in the achievement equation. Note the significant and negative coefficients for the southeast and southwest regions. Students, both Black and White, in these areas tend to score lower, on the average, than students from other regions. On the other hand, the estimated coefficients for those regions are positive and significant in the teachers' expectations equations for Whites and negative and significant for Blacks. These results are probably in accordance with our perceptions of the educational systems for those regions, but one should also point out that the Plains, Lakes and Mid-Atlantic states also have negative and significant coefficients in the teachers' expectations equation for Blacks.

Black students who live in metropolitan areas, SMSA, tend to achieve less well than do their rural counterparts. This tendency is reinforced by the fact that these students also perceive that their parents expect less of them. These observations do not obtain for White students.

The strong negative coefficient for sex in the structural form achievement equations indicates that males, both Black and White, perform better than females at the twelfth grade. This tendency is reinforced by the fact that males perceive that their parents expect more of them. On the other hand, females, both Black and White, tend to have higher motivation and greater self confidence and belief in their control of their own destiny which dampens the total effect of sex upon achievement.

The significant negative coefficient for age in the structural form achievement equation, for both Blacks and Whites, reflects the fact that school systems tend to advance the ablest student at a rate faster than average while requiring the poorer student to produce a negative coefficient for age. Thus, one naturally expects the system to produce a negative coefficient for age. Additionally, older Black twelfth grade students tend to have lower motivation and expectations which, in turn, further reduce achievement.

IV.III.II Community and Home Variables:

At least since the appearance of the EEOR, researchers have argued that the home has a profound effect upon achievement. This study also supports this view.

As expected, the more older brothers ans sisters that a person has, the worse he performs, on average. Parents, both Black and White, give more attention to the first children for the simple reason that with more children in the family, a parent can devote less time to any one. Any benefit derived from the older brothers and sisters is insufficient to overcome less attentiongiven by the parents.

Many studies agree that socioeconomic status, SES, has an important effect on achievement and this finding is supported by the positive and significant coefficients in the achievement equation for both Blacks and Whites. SES enters strongly and positively in the pupil's and parents' expectations equations and thus indirectly exerts a significant influence on achievement for both Blacks and Whites. On the other hand, this variable has a significant negative coefficient for Blacks in the motivation and the teachers' expectations equations. Black pupils with a low SES may see education as an excellent if not the only way to improve their status and, for this reason, may work harder than Black pupils from a high socioeconomic background.

The amount of information available to the pupil, INFO, is positive and significant for Whites in the achievement and expectations equations while it is only significant for perceived parents' expectations for Blacks. American families firmly believe in staying together for the sake of the children. The positive coefficient for TWOP, two parents alive and living at home, in both the reduced form and the structural form parents' expectations equations suggests that this conjecture has a certain validity for both Blacks and Whites.

Black students who rarely speak a foreign language in the home, FL, seem to have a higher motivation after controlling for all of the other variables, but the expectations of these students, both Black and White, are on average less than those of pupils who frequently speak a foreign language. On the other hand Blacks and Whites who speak a foreign language tend to be lower in efficacy.

A priori, one might think that reading before school, RBS, should have no influence on achievement at the twelfth grade since the benefits should accrue at earlier grades and not continue until the twelfth grade. The results support this conjecture. However, this variable appears to have permanent effects for Whites on a pupil's self concept and perceived teachers' expectations which, in turn, improve achievement scores. This observation does not obtain for Blacks.

Parents concern, measured by parents talking about school, PTAS, does, a priori, increase achievement. However, when included in this equation of the model, the regression coefficient for this variable is not significant in the structural form equation for either Blacks or Whites. On the other hand, the pupils'perceived parental expectations are higher on average for both races, the more frequently parents talk about school. Another measure of parents' concern, attendance at PTA meetings, PTAAT, seems to be related positively to higher expectations for both Blacks and Whites, but negatively to perceived parents' expectations for Whites.

Apparently, spending most of one's life in one place, TC, increases a Black pupil's achievement and motivation, perhaps by inducing competition among local friends. This observation does not obtain for Whites. Changing school frequently, NTCHSCL, appears for Whites to directly decrease a pupil's expectations, on average, but increases a pupil's perception of his parents' expectations. This observation does not hold for Blacks. On the other hand, for Blacks the coefficient for the last time a pupil changed schools is positive in the achievement equation and negative in both the own and perceived teachers' expectations equations. For both Blacks and Whites it is positive and significant in both the motivation and efficacy equations. On the whole, these results argue for geographical stability for both races.

IV.III.III School Variables: The Peer Group:

At least since the appearance of the Coleman Report, the peer group has been emphasized as an important contributor to individual achievement. A priori reasoning suggests that the average achievement level of pupils, AVACH, should increase the achievement level of an individual pupil. The positive reduced form and structural form coefficients for this variable in the achievement equation for both Blacks and Whites support this conjecture.

A secondary reason for including pupil's average achievement stems from the criticism by educators and sociologists that one cannot reasonably consider teacher effects as exogenous with individual pupil data. The arguement is that bright pupils attract better teachers and this phenomenon might result in observed but spurious positive coefficients for measures of teacher quality in an achievement equation. These coefficients should not be spurious here since we control for average achievement.

For reasons similar to those discussed above, average motivation, expectations and efficacy should enter their respective structural equations positively and significantly. The estimates confirm this reasoning.

The significant negative coefficient of MIX in the structural achievement equation for Blacks indicate that a Black pupil's achievement is higher in schools with over 70 percent Whites. This coefficient suggests that Blacks may benefit from integration. However, it argues that partial inegration into schools of less than 70 percent white may have no benefits on achievement. To be successful, integration must be complete, that is, Blacks should attend schools that are over 70 percent White. Only in this way may Blacks benefit from integration. However, the perceived teachers' expectations for Blacks seem higher in all Black schools. Probably for this reason the reduced form coefficients for the variables measuring the percentage of White students in a school in the schievement equation are insignificant. It is not clear from these results that integration benefits Black pupils.

Interestingly and in argreement with the speculations of the EEOR [ ] the proportion of Whites or Blacks in a school appears to have no effect on the achievement of Whites, though less than 10 percent of the Whites attend schools in which the proportion of Whites is less than 70 percent.

The significant negative coefficient for MLYBLCK in the structural form efficacy equation for Blacks suggests that the self concept of Black is lower in schools with less than 30 percent Whites. Again, this variable and MIX is insignificant in the structural form efficacy equation for Whites. After controlling for the proportion of Whites in the school, the proportion of White in the classroom, PWPICLY, is associated with higher individual pupil achievement for both Blacks and Whites. Interestingly the proportion of Whites in the classroom appears to directly increase White pupil motivation but decrease Black pupil motivation and efficacy. Perceived parents' expectations of both Black and White pupils seem unaffected by the proportion of Whites in the school or the classroom.

IV.IIIIVSchool Variables: Teachers' Characteristics:

Recent years appear to have witnessed increasing acceptance of the argument that variables associated with the schools contribute little to educational outcomes.[1] These results do not support this argument. They suggest, for example, that teachers make a significant contribution to the educational process, particularly for Blacks. Teachers' ability, measured by an achievement test, is significant in both the reduced form and the structural form equations for Blacks, but not for Whites. However, this variable is significant and positive for White in the structural form motivation and expectations equations. The number of teachers per pupil, which is often thought to be an irrelevant number appears to significantly increase a pupil's achievement for both Blacks and Whites. On the other hand, for some reason, this ratio appears to reduce White pupils' parents' expectations. Teachers' experience, measured by the number of years teaching, has a quadratic effect in both the achievement and efficacy reduced form equations for Blacks. As

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1. For example, see Jencks who is probably the most popular expositor of this idea [ ].

the number of years of teaching initially increases Black pupil's performance falls off,but.later, as teachers gain experience and perhaps as less able teachers leave the system, pupil's achievement increases. There is no such effect for White pupils except in the structural form expectations and perceived parents' expectation equations.

The proportion of White teachers significantly increases White and Black pupil motivation. The reduced form coefficient for this variable in the achievement equation is positive and significant for Whites, but not for Blacks. For some reason, Whites' achievement seems higher in schools with more male teachers while Black achievement seems higher in schools with more female teachers. Male teaching also appears to stimulate White pupil's expectations and efficacy and yet, the perceived teachers' expectations are higher for Blacks and Whites in schools with more female teachers. The proportion of teachers spending most of their lives in the city or town where they presently live, TPTC, has a direct effect on perceived teachers' expectations for both Blacks and Whites.

Unofrtunately, this body of data does not include a variable for the degree of interaciton between the pupils and the teachers in the classroom, nor are there measures of teaching materials. However, this body of evidence does suggest that teachers' characteristics are, on the whole, an important component in the educational process. Looking only at the reduced form achievement equations, teachers seem to be more important for Blacks than for Whites.

IV. III. V School Variables

These results also suggest that variables associated with the school are important to the educational process. Again, this result seems to apply more to Blacks than to Whites. School facilities, for example, enter positively and significantly both the reduced form and structural form achievement and motivation equations for Blacks, but not Whites. Problems in the school, PROBLEMS, an index including problems of drinking intoxicants, drugs, discourtesy to teachers and damage to school property, has an significant negative coefficient in the reduced form and structural form achievement equations forboth Blacks and Whites. Even AGES, an index which measures the age of the school, is negatively associated with perceived parents' expectations for both Blacks and Whites. Schools which have a principal with an advanced degree tend to have Black students with higher efficacy.

As expected, schools which have a policy of administering achievement and I.Q. tests to their students also have pupils who score significantly higher on the various tests which are used here to measure achievement. Students who talk more often with guidance counselors tend to have higher expectations and a greater sense of their own efficacy. On the other hand, they appear to perceive that their parents expect less of them than those who do not make so much use of the guidance counselors. Perhaps, because they view frequent visits to the guidance counselor as a sign of poor achievement, undecidedness and future difficulty. These results appear to h ld for both Blacks and Whites.

V. Concluding Remarks

Our paper attempts to provide anthropologists with an understanding of the applicability of modelling the educational process by simultaneous equations. There are strong a priori reasons for believing that the educational process is simultaneous and these reasons appear to be justified by the results. Our paper also attempts to provide an outline of how to estimate such models by two stage least squares. We provide examples of the application of the technique by estimating models of the educational process for Blacks and Whites, and discuss the differences between the two groups.

The simultaneous approach produces estimates which both tend to support some of the findings of previous studies and tend to be somewhat different from other results. It may be worthwhile to review briefly some of the high points

First, at least since the EEOR, researchers have emphasized the importance of parents and variables associated with the home. The above work certainly is in general agreement with the notion that the home is important. However, while other studies, especially the EEOR,viewed the home as something given, the above results indicate that even home variables may be somewhat manipulable. The existence of information in the home as evidenced by books, magazine, encyclopedia and newspapers is importantly related to achievement, motivation, expectations, and to a lesser extent, to efficacy. Furthermore, reading before school even for twelfth grade pupils, is related to both expectations and efficacy. Again, this result holds for both White and Black pupils. Hence, there are actions available to change home factors, at least at the level of giving advice to parents.

Peer group influences have also been emphasized in the literature. The results reported here do not deny the importance of peer groups and the measures of average achievement, motivation, expectation and efficacy enter importantly into the structural equations. Yet, one might legitimately wonder whether these school-wide averages are adequate indices for the measurement of peer group influences and question whether the empirical results whould be accorded such an interpretation rather than merely being instruments to help control for bias and spurious relationships as was argued above.

Recently, Armor [ ] restarted an academic discussion on the integration issues. In this paper, interest centers upon measures of the racial composition of the schools in an effort to determine how these relate to the endogenous variables. Perhaps unfortunately, no single clear policy, such as integrate, segregate, or bus, emerges. In general, however, we see that the racial composition of the school affects the attitudes and achievement of Black pupils more than it does for White pupils.

There appears to be a growing belief that inputs into the educational process are almost unrelated to outputs. This study does not support such a view. Teachers, for example, even with the crude measures available here, appear to be very important. The much discussed pupil-teacher ratio, believed by parents to be important but often viewed as irrelevant by researchers and administrators, is strongly and positively related to achievement. Similarly, the intelligence of the teachers, as it is measured by their own score on a verbal aptitude test, is important for achievement. Even variables associated with the school, such as facilities and problems, appear to be important in the educational process.[1] Again the major difference between the Blacks and the Whites is that the teachers and the characteristics of the school appear to be much more important for Blacks than for Whites.

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[1] This finding supports Mayeske's [ ] overwhelming impression that schools are indeed important.

APPENDIX I: DEXCRIPTION OF VARIABLES

Endogenous Variables

Abbreviation	Variable Name	Mean (Standard) Deviation		Description
		Blacks	Whites	
ACH	**Achievement**	-1.644 (2.964)	2.607 (3.187)	An index* constructed from the following standardized variables: verbal right (VR), nonverbal right (NVR), reading right (RR), math right (MR) and general information total right (GITR). (A high score indicates many correct answers.)
MOT	**Motivation**	0.422 (1.484)	0.161 (1.625)	An index constructed from the following standardized variables: go far in school (FARSCL), happy to quit school (HPYTOTSCL), desire in school (DESINSCL), number of hours study (NHRSTUDY), number of days stay from school (NDSTAYFS), participation in athletics, student council, debating (PART). (A high score indicates high motivation.)
EXP	**Expectations**	0.532 (1.596)	0.321 (1.756)	An index constructed from desire to go to college (COLLEGE) and job expectations (JOBEXP). (A high score indicates high expectations.)
EFF	**Efficacy**	-0.359 (3.905)	1.565 (2.856)	An index constructed from the following standardized variables: people are happier who accept their condition (EACPT), good luck is more important than hard work for success (EHWORK), get ahead somebody stops me (EAHEAD), lack of success is own fault (ESUCCESS), whatever education hard to get job (EHJOB), would make any sacrifice to get ahead (ESAC), would like to change to be somebody different (ECHANGE), sometimes can't learn (ELEARN), teachers go too fast (EFSTTCH), not much chance for success (ECNCESUC), tougher the job harder work (ETGHJOB), able to do many things (EABLE). (A high score indicates a high feeling of control and self-concept.)
PAEXP^{P}	**Perceived Parents' Expectations**	0.495 (2.059)	0.257 (2.249)	An index constructed from the following standardized variables: mother's and father's desire about student's performance in class (MOSEXP and FASEXP, respectively), father's and mother's expectations about the student's future education (FAJEXP and MOJEXP, respectively). (A high score indicates high parental expectations.)

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* All indices came from the first factor of a principal components analysis.

Endogenous Variables (continued)

Abbreviation	Variable Name	Mean (Standard Deviation) Blacks	Mean (Standard Deviation) Whites	Description
TEXP^{p}	Perceived Teachers' Expectations	-4.045 (1.675)	-4.145 (1.487)	Teachers expect student to be one of the best in class = -2, good enough to get by = -8 (A high score indicates high teacher's expectations).

Exogenous Variables:

Abbreviation	Variable Name	Blacks	Whites	Description
CONST	Constant	1.000 (0.000)	1.000 (0.000)	
AVACH	Average Achievement	0.083 (0.702)	0.218 (0.533)	Average Achievement for pupils in a school.
AVMOT	Average Motivation	-0.232 (0.206)	-0.247 (0.193)	Average Motivation for pupils in a school.
AVEXP	Average Expectation	-0.376 (0.160)	-0.367 (0.208)	Average Expectation for pupils in a school.
AVEFF	Average Efficacy	0.165 (0.463)	0.259 (0.391)	Average Efficacy for pupils in a school.
NEWENG	New England	0.014 (0.118)	0.061 (0.239)	New England States = 1, otherwise = 0
MIDATL	Mid Atlantic	0.231 (0.422)	0.197 (0.398)	Mid Atlantic States = 1, otherwise = 0
LAKES	Great Lakes	0.190 (0.392)	0.213 (0.410)	Great Lakes States = 1, otherwise = 0
PLAINS	Plains	0.026 (0.160)	0.077 (0.267)	Plains States = 1, otherwise = 0
SEAST	South East	0.393 (0.489)	0.196 (0.397)	South Eastern States = 1, otherwise = 0
SWEST	South west	0.065 (0.247)	0.075 (0.264)	South Western States = 1, otherwise = 0 (The excluded category contains students from the far west and Rocky Mountain states)
SMSA	Metropolitan Area	1.321 (0.467)	1.333 (0.471)	Within standard metropolitan statistical area = 1, otherwise = 2

Exogenous Variables

Abbreviation	Variable Name	Mean (Standard Deviation) Blacks	Whites	Description
SEX	Sex	3.121 (0.991)	2.995 (0.999)	Male = 2, female = 4.
AGE	Age	4.012 (0.841)	3.939 (0.665)	Less than 14 = 1, ... , 20 or older = 7
NOBAS	Number of older brothers and sisters	3.050 (2.223)	2.187 (1.556)	None older = 1, ... , 8 or more older = 9
SES	Socio-economic Status	-0.359 (2.092)	1.241 (2.130)	An index constructed from the first principal component of the following standardized variables: father's occupational level (FAOCC), father's and mother's educational level (FAEDD and MOEDD, respectively). Encyclopedia in home (ENCYIH), attended kindergarten and nursery school (KNGTEN and NURSERY, respectively), number of hours work for pay (NHWFPAY), number of people per room in the house (DENSITY). (A high value means a high socio-economic status.)
INFO	Information Available	-0.487 (1.628)	0.656 (1.437)	An index constructed from the following standardized variables: dictionary in home (DICTIH), daily newspaper in home (DNEWSIH), trips to library (LIB), number of magazines, and books in home (NMIH and NBIH, respectively). (A high value indicates high availability of information.)
TWOP	Two Parents	0.525 (0.499)	0.803 (0.398)	Two parents alive and living at home = 1, otherwise = 0.
FL	Foreign Language	3.619 (0.764)	3.616 (0.736)	Frequently speak a foreign language out of school = 1, ... , never speak a foreign language = 4
TC	This City	0.821 (0.384)	0.779 (0.415)	Spent most of life in this city or town = 1, otherwise = 0.
RBS	Reading Before School	2.579 (1.227)	2.646 (1.137)	Not read before going to school = 1, ..., regularly read before going to school = 4
PTAS	Parents Talking About School	1.805 (0.989)	1.853 (1.068)	Parents talk about school once a day = 1, ..., parents never or hardly ever talk about school = 4

Exogenous Variables

Abbreviation	Variable Name	Mean (Standard Deviation)		Description
		Blacks	Whites	
NHWTV	Watching Television	4.279 (2.181)	3.780 (1.962)	Not watch TV = 1, ... , 4 hours or more per day = 7.
NHWTV2	(Watching TV)^2	23.068 (17.628)	18.138 (15.299)	
NTCHSCL	Number of times changed school	2.430 (1.439)	2.471 (1.533)	Never changed school = 1, ... , changed school four or more times = 5
LSTCHSCL	Last time changed school	6.158 (1.531)	6.197 (1.495)	Changed school within a year = 2, ... , changed school five or more years ago = 7
TEST	Testing Experience	1.637 (0.533)	1.776 (0.441)	School gives intelligence tests and standardized achievement tests = 2, school gives intelligence or standard achievement tests = 1, otherwise = 0.
PTAAT	Parents attend PTA	1.970 (1.103)	1.625 (0.992)	Parents not go to PTA = 1, ... , parents go most of the time = 4.
NTLKGC	Number of times talk to guidance counselor last year	2.448 (1.304)	2.805 (1.184)	Not talk = 1, ... , talk six or more times = 5.
PWPICLY	Proportion of white pupils in class last year	2.020 (1.273)	4.280 (0.882)	No whites = 1, ... , all white = 5.
MLYBLCK	Mainly black school	0.657 (0.475)	0.034 (0.180)	Less than 30% white = 1, otherwise = 0
MIX	Integrated school	0.125 (0.331)	0.054 (0.226)	30 - 69% white = 1, otherwise = 0
PWTCHLY	Proportion of white teachers in class last year	2.523 (1.670)	4.726 (0.765)	No white teachers = 1, ... , all white teachers = 5.
TAVR	Teachers' average verbal right	29.448 (0.527)	29.678 (0.300)	Teachers' average verbal right for all teachers in the school.
NTPRPUP	Number of teachers per pupil	0.042 (0.073)	0.045 (0.009)	
TPTC	Proportion of teachers from this city.	0.464 (0.236)	0.388 (0.225)	All from this city = 1, ... , none from this city = 0.

Abbreviation	Variable Name	Mean (Standard Deviation) Blacks	Mean (Standard Deviation) Whites	Description
TASEX	Teachers sex	2.992 (0.249)	2.897 (0.276)	All males = 2, ..., All females = 4
TANYTCH	Teachers average number of years teaching	4.467 (0.641)	4.386 (0.662)	No years teaching = 1,..., 30 or more years = 8.
TANYTCH2	(Teachers average number of years teaching)^2	20.367 (5.709)	19.679 (5.873)	
TPADTN	Teachers problems with administration	0.130 (0.151)	0.096 (0.143)	Lack of effective leadership from school administrator = 1,..., no problem = 0.
NTCHLV	Number of teachers who leave	1.869 (1.177)	2.409 (1.465)	Less than 5% left = 1,..., more than 50% left = 7.
AGES	Age of school	4.843 (1.654)	4.575 (1.761)	Main classroom less than one year old = 1,..., more than 39 years old = 7.
PROBLEMS	Problems in the school	168.390 (2.610)	167.160 (2.198)	Constructed from problems of damage, impertinance, discourtesy and violence to teachers racial tension, stealing, drugs and drinking. (High value corresponds to many problems.)
FACILITS	School facilities	11.975 (2.173)	12.677 (1.388)	Principals responses about the school library, auditorium, gymnasium, laboratories, etc. (High value corresponds to many facilities.)
PPRNMADEG	Principal has Master's Degree	4.303 (0.657)	4.215 (0.597)	No degree = 1,..., Doctorate = 6.

APPENDIX II: REDUCED AND STRUCTURAL FORM ESTIMATES OF THE EDUCATIONAL PROCESS MODEL FOR BLACKS AND WHITES

Achievement Equation

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH				
MOT				
EXP		0.278 (2.393)		0.565 (3.799)
EFF		0.299 (5.894)		0.382 (4.509)
PAEXP^p				
TEXP^p				
CONST	4.326 (1.078)		7.621 (1.367)	10.442 (3.321)
AVACH	0.303 (3.514)	0.175 (3.321)	0.529 (4.517)	0.221 (3.129)
AVMOT	0.663 (2.175)		0.331 (1.167)	
AVEXP	0.130 (0.388)		-0.236 (-0.809)	
AVEFF	-0.018 (-0.165)		-0.342 (-2.259)	
NEWENG	-0.248 (-0.650)		-0.023 (-0.103)	
MIDATL	0.572 (2.864)	0.346 (2.029)	0.300 (1.772)	0.290 (2.103)
LAKES	0.818 (4.574)	0.645 (4.207)	0.019 (0.134)	0.221 (1.864)
PLAINS	0.939 (3.069)	0.752 (2.748)	0.950 (5.156)	0.739 (4.720)
SEAST	0.131 (0.577)	—0.172 (—0.943)	0.042 (0.236)	—0.255 (—1.716)
SWEST	0.201 (0.780)	—0.069 (—0.328)	0.030 (0.155)	—0.289 (—1.820)
SMSA	-0.420 (-3.426)	—0.592 (—5.432)	0.002 (0.022)	
SEX	-0.129 (-3.224)	—0.276 (—6.856)	-0.344 (-8.202)	—0.243 (—4.704)
AGE	-0.432 (-9.061)	-0.217 (-4.659	-0.566 (-8.829)	-0.274 (-4.310)
NOBAS	-0.098 (-5.407)	-0.076 (-4.509)	-0.182 (-6.560)	-0.135 (-5.365)
SES	0.278 (12.093)	0.172 (6.038)	0.302 (12.535)	0.128 (4.020)
INFO	0.051 (1.768)		0.385 (10.968)	0.165 (3.833)
TWOP	0.074 (0.936)		0.008 (0.072)	
FL	-0.119 (-2.313)		-0.010 (-0.175)	0.089 (1.525)
TC	0.260 (2.467)	0.291 (3.025)	-0.313 (-2.690)	

Achievement Equation (cont.)

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
RBS	0.048 (1.427)		0.180 (4.638)	
PTAS	0.151 (3.642)		0.072 (1.746)	
NHWTV	0.516 (5.955)		0.315 (3.350)	
NHWTV2	-0.063 (-5.821)		-0.065 (-5.387)	
NTCHSCL	-0.021 (-0.695)		-0.063 (-1.874)	
LSTCHSCL	0.069 (2.448)	0.048 (1.918)	0.062 (1.910)	
TEST	0.224 (2.705)	0.280 (3.718)	0.318 (3.080)	0.318 (3.603)
PTAAT	-0.074 (-1.936)		-0.089 (-2.027)	
NTLKGC	0.323 (10.103)		0.197 (5.357)	
PWPICLY	0.240 (3.818)	0.280 (5.519)	0.159 (2.809)	0.186 (4.091)
MLYBLCK	-0.111 (-0.701)	-0.128 (-0.883)	-0.063 (-0.260)	
MIX	-0.071 (-0.455)	-0.257 (-1.875)	-0.217 (-1.043)	
PWTCHLY	0.044 (0.866)		0.124 (2.072)	
TAVR	0.179 (2.217)	0.149 (2.597)	0.009 (0.059)	
NTPRPUP	14.181 (2.313)	23.832 (4.341)	8.150 (1.496)	10.729 (2.327)
TPTC	-0.456 (-1.925)	-0.229 (-1.156)	-0.389 (-1.492)	-0.457 (-2.368)
TASEX	0.280 (1.590)	0.275 (1.752)	-0.168 (-0.908)	-0.284 (-1.721)
TANYTCH	-1.041 (-1.737)		-0.224 (-0.405)	
TANYTCH2	0.148 (2.193)		0.039 (0.629)	
TPADTN	0.449 (1.589)		0.404 (1.295)	
NTCHLV	-0.009 (-0.241)	-0.035 (-1.000)	0.009 (0.273)	
AGES	0.019 (0.604)		-0.023 (-0.838)	
PROBLEMS	-0.061 (-3.614)	-0.042 (-4.305)	-0.026 (-1.258)	-0.048 (-2.710)
FACILITS	0.038 (1.767)	0.065 (3.447)	-0.023 (-0.711)	
PRNMADEG	-0.254 (-3.798)		-0.031 (-0.409)	
MLR^2	0.2749	0.4070	0.2656	0.4276
ALTR^2	0.2749	0.2595	0.2656	0.2519

Motivation Equation

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH		0.126 (3.267)		
MOT				
EXP				0.248 (3.085)
EFF				
PAEXP^P		0.508 (10.015)		0.178 (1.905)
TEXP^P		0.228 (2.707)		0.557 (3.998)
CONST	2.419 (1.133)		5.362 (1.876)	
AVACH	0.063 (1.367)		-0.005 (-0.087)	
AVMOT	0.495 (3.052)	0.171 (1.747)	0.619 (4.255)	0.193 (1.836)
AVEXP	-0.109 (-0.611)		-0.071 (0.476)	
AVEFF	-0.028 (-0.467)		0.015 (0.200)	
NEWENG	0.055 (0.273)	0.429 (2.255)	-0.268 (-2.387)	
MIDATL	0.084 (0.787)	0.029 (3.508)	-0.200 (-2.300)	
LAKES	0.146 (1.534)	0.202 (2.283)	-0.118 (-1.618)	
PLAINS	0.141 (0.864)	0.229 (1.538)	-0.0003 (-0.003)	
SEAST	0.583 (4.813)	0.549 (5.742)	0.344 (3.716)	0.157 (2.613)
SWEST	0.563 (4.105)	0.369 (3.204)	0.437 (4.347)	
SMSA	0.036 (0.551)		0.071 (1.216)	
SEX	0.067 (3.154)	0.165 (6.679)	-0.063 (-2.913)	0.924 (2.557)
AGE	-0.189 (-7.434)	-0.048 (-1.764)	-0.208 (-6.350)	
NOBAS	-0.004 (-0.456)	0.017 (1.682)	-0.023 (-1.615)	
SES	0.008 (6.773)	-0.079 (-3.714)	0.115 (9.281)	
INFO	0.063 (4.098)		0.205 (11.432)	0.027 (1.314)
TWOP	0.013 (0.297)	-0.185 (-3.881)	-0.012 (-0.223)	
FL	0.013 (0.489)	0.052 (1.967)	-0.135 (-4.645)	
TC	0.042 (0.755)	0.044 (0.798)	-0.092 (-1.540)	

Motivation Equation (cont.)

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
RBS	0.068 (3.804)		0.075 (3.754)	
PTAS	-0.139 (-6.296)		-0.184 (-8.657)	-0.089 (-3.257)
NHWTV	0.191 (4.127)		0.153 (3.181)	
NHWTV2	-0.031 (-5.352)		-0.033 (-5.335)	
NTCHSCL	-0.029 (-1.784)		-0.028 (-1.608)	-0.015 (-0.958)
LSTCHSCL	0.068 (4.569)	0.051 (3.646)	0.086 (5.120)	0.051 (3.419)
TEST	-0.078 (-1.757)		-0.136 (-2.561)	
PTAAT	0.080 (3.948)		0.065 (2.897)	
NTLKGC	0.146 (8.598)		0.101 (5.353)	
PWPICLY	-0.039 (-1.175)	-0.031 (-2.436)	0.063 (2.170)	0.054 (2.118)
MLYBLCK	0.238 (2.816)	-0.042 (-0.521)	0.232 (1.867)	0.118 (1.082)
MIX	0.169 (2.018)	0.094 (1.208)	0.237 (2.227)	
PWTCHLY	0.041 (1.523)	0.041 (1.602)	0.113 (3.676)	0.061 (2.146)
TAVR	0.002 (0.037)		-0.087 (-1.188)	0.047 (1.844)
NTPRPUP	-2.174 (-0.666)		-3.607 (-1.292)	
TPTC	0.140 (1.106)		0.191 (1.432)	
TASEX	0.016 (0.174)		-0.027 (-0.282)	
TANYTCH	-0.541 (-1.696)	0.224 (1.273)	-0.207 (-0.729)	
TANYTCH2	0.066 (1.845)	-0.026 (-1.403)	0.033 (1.058)	
TPADTN	0.263 (1.750)		0.014 (0.088)	
NTCHLV	0.039 (1.929)		0.015 (0.904)	
AGES	-0.014 (-0.824)		-0.012 (-0.839)	0.011 (0.894)
PROBLEMS	-0.008 (-0.851)		-0.011 (-1.013)	
FACILITS	-0.032 (-2.790)	-0.021 (-1.884)	-0.020 (-1.208)	
PRNMADEG	-0.030 (-0.827)		-0.017 (-0.437)	
MLR^2	0.1805	0.526	0.2578	0.546
ALTR^2	0.1805	0.176	0.2578	0.252

Expectation Equation

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH		0.092 (2.827)		0.099 (3.584)
MOT		0.497 (4.569)		0.253 (2.377)
EXP				
EFF				
PAEXP^p		0.195 (2.961)		0.222 (3.122)
TEXP^p				
CONST	4.417 (1.986)	3.036 (2.216)	2.656 (0.891)	
AVACH	0.018 (0.372)		-0.104 (-1.659)	
AVMOT	-0.032 (-0.191)		-0.042 (-0.274)	
AVEXP	0.793 (4.261)	0.556 (4.446)	0.712 (4.561)	0.326 (3.641)
AVEFF	-0.025 (-0.412)		0.043 (0.533)	
NEWENG	-0.251 (-1.187)		-0.309 (-2.642)	
MIDATL	-0.241 (-2.178)	-0.234 (-4.223)	-0.334 (-3.691)	-0.174 (-2.945)
LAKES	0.012 (0.120)		-0.385 (-5.053)	-0.237 (-4.691)
PLAINS	0.123 (0.725)		-0.047 (-0.473)	
SEAST	0.095 (0.756)	-0.127 (-1.819)	-0.217 (-2.252)	-0.311 (-4.940)
SWEST	0.261 (0.183)		0.116 (1.104)	
SMSA	0.045 (0.661)		0.041 (0.677)	
SEX	0.038 (1.720)	0.051 (1.802)	-0.211 (-9.395)	-0.053 (-1.502)
AGE	-0.187 (-7.090)	-0.037 (-1.194)	-0.227 (-6.628)	
NOBAS	-0.024 (-2.438)		-0.036 (-2.447)	
SES	0.168 (13.174)	0.059 (2.900)	0.193 (14.963)	0.090 (5.925)
INFO	0.084 (5.278)	0.019 (1.189)	0.230 (12.289)	0.081 (4.139)
TWOP	0.126 (2.856)		-0.059 (-1.018)	
FL	-0.111 (-3.891)	-0.102 (-3.854)	-0.173 (-5.689)	-0.098 (-3.730)
TC	-0.027 (-0.466)	-0.064 (-1.173)	-0.182 (-2.918)	

Expectation Equation (cont.)

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
RBS	0.062 (3.344)	0.003 (0.216)	0.079 (3.800)	0.013 (0.748)
PTAS	-0.087 (-3.772)		-0.098 (-4.416)	
NHWTV	0.194 (4.036)		0.112 (2.225)	
NHWTV2	-0.030 (-5.012)		-0.025 (-3.934)	
NTCHSCL	-0.045 (-2.618)	-0.018 (-1.144)	-0.052 (-2.882)	-0.032 (-2.291)
LSTCHSCL	0.004 (0.253)	-0.004 (-2.314)	0.047 (2.714)	
TEST	-0.037 (-0.811)		-0.010 (-0.177)	
PTAAT	0.079 (3.761)	0.031 (1.508)	0.088 (3.758)	0.072 (3.518)
NTLKGC	0.231 (13.054)	0.107 (4.771)	0.154 (7.843)	0.086 (5.115)
PWPICLY	-0.009 (-0.258)		0.023 (0.760)	
MLYBLCK	0.205 (2.328)		0.131 (1.010)	
MIX	0.235 (2.698)	0.117 (1.777)	-0.032 (-0.287)	
PWTCHLY	0.063 (2.262)	0.019 (0.963)	0.038 (1.179)	
TAVR	0.057 (1.281)		-0.076 (-0.993)	
NTPRPUP	-6.970 (-2.051)		-2.346 (-0.806)	
TPTC	0.009 (0.067)		0.252 (1.809)	0.173 (1.621)
TASEX	0.051 (0.520)		0.246 (2.480)	0.168 (2.406)
TANYTCH	-0.475 (-1.431)		-0.050 (-0.169)	-0.165 (-1.493)
TANYTCH2	0.065 (1.733)		0.013 (0.402)	0.022 (1.670)
TPADTN	0.428 (2.729)		0.166 (0.996)	
NTCHLV	0.035 (1.671)		0.006 (0.367)	
AGES	-0.027 (-1.508)		-0.005 (-0.326)	
PROBLEMS	-0.025 (-2.681)	-0.015 (-1.843)	0.004 (0.376)	
FACILITS	-0.031 (-2.635)		-0.016 (-0.908)	
PRNMADEG	-0.039 (-1.054)		0.031 (0.755)	
MLR^2	0.2318	0.475	0.3089	0.5185
ALTR^2	0.2318	0.228	0.3089	0.3038

Efficacy Equation

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH		0.462 (4.928)		0.284 (6.106)
MOT				
EXP				
EFF				
$PAEXP^P$				
$TEXP^P$		1.267 (6.580)		0.854 (4.922)
CONST	-12.715 (-2.212)		-7.110 (-1.331)	5.644 (1.438)
AVACH	-0.393 (-3.187)		-0.260 (-1.869)	
AVMOT	-0.112 (-0.257)		-0.048 (-0.175)	
AVEXP	0.104 (0.216)		-0.222 (-0.794)	
AVEFF	0.982 (6.183)	0.408 (3.509)	0.916 (6.319)	0.573 (5.855)
NEWENG	0.954 (1.745)		-0.034 (-0.161)	0.072 (0.435)
MIDATL	1.329 (4.643)		0.195 (1.205)	
LAKES	0.947 (3.693)		-0.106 (-0.774)	
PLAINS	1.867 (4.261)	0.931 (2.778)	0.306 (1.734)	
SEAST	1.156 (3.547)		0.452 (2.614)	0.081 (0.619)
SWEST	1.236 (3.346)		0.332 (1.766)	
SMSA	0.500 (2.845)	0.708 (4.930)	0.197 (1.818)	0.097 (1.059)
SEX	0.407 (7.097)	0.393 (7.275)	0.049 (1.224)	0.184 (4.478)
AGE	-0.502 (-0.735)	-0.542 (-0.622)	-0.418 (-6.814)	-0.148 (-2.294)
NOBAS	-0.043 (-1.680)	-0.007 (-0.264)	-0.046 (-1.716)	
SES	0.170 (5.156)	-0.025 (-0.569)	0.168 (7.258)	
INFO	0.066 (1.602)		0.232 (6.899)	
TWOP	-0.031 (-0.275)		-0.076 (-0.735)	
FL	0.052 (0.711)	0.199 (2.851)	0.021 (0.383)	0.141 (2.386)
TC	-0.113 (-0.748)		-0.182 (-1.633)	

Efficacy Equation (cont.)

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
RBS	0.158 (3.303)	0.067 (1.463)	0.285 (7.661)	0.147 (3.693)
PTAS	0.078 (1.314)		-0.061 (-1.551)	-0.062 (-1.600)
NHWTV	0.360 (2.900)		0.333 (3.697)	0.241 (2.734)
NHWTV2	-0.050 (-3.241)		-0.059 (-5.124)	-0.034 (-2.977)
NTCHSCL	-0.089 (-2.017)		-0.050 (-1.550)	
LSTCHSCL	0.073 (1.809)	0.080 (2.258)	0.090 (2.873)	0.047 (1.840)
TEST	-0.053 (-0.442)		0.016 (0.165)	
PTAAT	0.036 (0.654)		-0.053 (-1.271)	
NTLKGC	0.682 (14.885)	0.249 (3.356)	0.239 (6.771)	0.132 (3.750)
PWPICLY	-0.146 (-1.621)	-0.222 (-2.566)	0.016 (0.299)	
MLYBLCK	-0.200 (-0.878)	-0.480 (-2.604)	0.173 (0.744)	
MIX	0.048 (0.215)		-0.010 (-0.048)	
PWTCHLY	0.147 (2.034)	0.089 (1.439)	0.175 (3.039)	0.052 (1.031)
TAVR	0.261 (2.250)	0.049 (1.509	0.073 (0.528)	0.235 (1.745)
NTPRPUP	-23.728 (-2.700)		0.773 (0.148)	
TPTC	-0.449 (-1.324)		-0.122 (-0.488)	
TASEX	0.121 (0.480)		0.179 (-1.006)	0.273 (1.725)
TANYTCH	-0.396 (-1.625)		-0.541 (-1.022)	
TANYTCH2	0.221 (2.277)		0.055 (0.938)	
TPADTN	0.920 (2.272)		-0.337 (-1.129)	
NTCHLV	0.080 (1.463)	-0.018 (-1.526)	-0.027 (-0.866)	
AGES	-0.021 (-0.455)		0.018 (0.697)	
PROBLEMS	0.023 (0.930)		0.034 (1.758)	
FACILITS	-0.071 (-2.327)		-0.056 (-1.838)	
PRNMADEG	0.080 (0.828)	0.183 (2.065)	0.050 (0.681)	
MLR^2	0.1423	0.3881	0.1610	0.3421
$ALTR^2$	0.1423	0.1299	0.1610	0.1529

Perceived Parents' Expectations Equation

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH				
MOT		0.493 (3.459)		0.369 (2.370)
EXP		0.309 (2.357)		0.446 (3.798)
EFF				
PAEXP^P				
TEXP^P		0.320 (1.860)		0.711 (3.384)
CONST	3.603 (1.251)	2.781 (3.627)	13.658 (3.609)	6.582 (5.530)
AVACH	-0.060 (-0.973)		0.025 (0.317)	
AVMOT	0.095 (0.434)		0.617 (3.201)	
AVEXP	0.168 (0.698)		0.194 (0.981)	
AVEFF	0.030 (0.371)		-0.021 (-0.205)	
NEWENG	-0.733 (-2.677)	-0.393 (-1.730)	-0.639 (-4.300)	-0.187 (-1.490)
MIDATL	-0.569 (-3.9 68)	-1.102 (-1.370)	-0.287 (-2.495)	0.024 (0.271)
LAKES	-0.203 (-1.584)		-0.314 (-3.243)	-0.051 (-0.681)
PLAINS	-0.360 (-1.639)		-0.155 (-1.243)	-0.114 (-1.117)
SEAST	-0.132 (-0.807)		0.233 (1.901)	
SWEST	0.079 (0.426)		0.434 (3.262)	
SMSA	-0.024 (-0.272)	-0.173 (-2.410)	0.134 (1.747)	0.029 (0.452)
SEX	-0.196 (-6.843)	-0.261 (-9.988)	-0.485 (-17.020)	-0.346 (-11.132)
AGE	-0.068 (-1.990)	0.135 (3.690)	-0.380 (-8.738)	-0.102 (-2.462)
NOBAS	-0.020 (-1.5 41)	-0.001 (-0.972)	-0.017 (-0.877)	
SES	0.229 (13.879)	0.124 (5.195)	0.221 (13.515)	0.042 (1.871)
INFO	0.106 (5.148)	0.043 (2.067)	0.279 (11.720)	
TWOP	0.402 (7.046)	0.365 (6.640)	0.151 (2.067)	0.151 (2.311)
FL	-0.014 (-0.381)		-0.234 (-6.083)	
TC	-0.047 (-0.627)		-0.018 (-0.222)	0.083 (1.135)

Perceived Parents' Expectations Equation (cont.)

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
RBS	0.093 (3.859)		0.096 (3.656)	
PTAS	-0.327 (-10.977)	-0.220 (-7.190)	-0.030 (-10.713)	-0.169 (-5.150)
NHWTV	0.158 (2.541)		0.047 (0.742)	
NHWTV2	-0.029 (-3.733)		-0.023 (-2.793)	
NTCHSCL	-0.038 (-1.713)	0.012 (0.565)	0.033 (1.452)	0.068 (3.269)
LSTCHSCL	0.024 (1.193)	-0.014 (-0.676)	0.044 (1.983)	-0.027 (-1.268)
TEST	-0.159 (-2.667)		-0.153 (-2.180)	
PTAAT	0.098 (3.595)		0.030 (1.028)	-0.063 (-2.326)
NTLKGC	0.096 (4.183)	-0.121 (-3.371)	0.119 (4.740)	-0.037 (-1.451)
PWPICLY	0.020 (0.438)		0.018 (0.457)	
MLYBLCK	0.507 (4.447)	0.111 (1.169)	0.170 (1.035)	
MIX	0.073 (0.650)	-0.146 (-1.424)	0.073 (0.520)	
PWTCHLY	-0.002 (-0.049)		0.060 (1.484)	
TAVR	0.031 (0.536)		-0.241 (-2.478)	
NTPRPUP	-5.441 (-1.236)		-14.256 (-3.857)	-9.051 (-2.817)
TPTC	0.468 (2.749)		0.105 (0.591)	-0.279 (-1.723)
TASEX	0.070 (0.554)		0.038 (0.304)	
TANYTCH	-0.196 (-0.455)		-0.846 (-2.256)	-0.551 (-1.734)
TANYTCH2	0.022 (0.453)		0.099 (2.371)	0.061 (1.714)
TPADTN	0.099 (0.487)		0.064 (0.301)	
NTCHLV	0.021 (0.757)		-0.016 (-0.730)	
AGES	-0.072 (-3.150)	-0.047 (-2.466)	-0.045 (-2.411)	-0.032 (-2.004)
PROBLEMS	-0.012 (-0.989)		-0.001 (-0.058)	
FACILITS	-0.021 (-1.355)	0.011 (0.814)	-0.047 (-2.161)	
PRNMADEG	-0.053 (-1.098)		0.021 (0.403)	
MLR^2	0.2254	0.4562	0.3207	0.6431
ALTR^2	0.2254	0.2204	0.3207	0.3191

Perceived Teachers' Expectations Equation

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
ACH				
MOT		0.563 (5.175)		
EXP				0.156 (1.930)
EFF		0.196 (5.890)		0.121 (3.244)
$PAEXP^p$				0.135 (2.686)
$TEXP^p$				
CONST	-6.495 (-2.577)	-6.152 (-2.453)	2.374 (0.828)	-4.307 (-14.178)
AVACH	-0.030 (-0.550)		0.005 (0.086)	
AVMOT	0.034 (-0.177)		0.332 (2.280)	
AVEXP	0.117 (0.554)		-0.019 (-0.127)	
AVEFF	0.149 (2.140)		-0.030 (-0.382)	
NEWENG	0.258 (1.075)	-0.057 (-0.244)	-0.320 (-2.839)	
MIDATL	-0.084 (-0.666)	-0.450 (-3.619)	-0.151 (-1.732)	
LAKES	-0.021 (-0.184)	-0.364 (-3.291)	-0.096 (-1.306)	0.059 (1.125)
PLAINS	0.065 (0.340)	-0.443 (-2.345)	-0.063 (-0.667)	
SEAST	0.258 (1.806)	-0.317 (-2.216)	0.220 (2.377)	0.248 (3.336)
SWEST	0.273 (1.684)	-0.285 (-1.804)	0.282 (2.797)	0.239 (2.933)
SMSA	0.112 (1.453)	0.013 (0.168)	0.112 (1.919)	
SEX	0.061 (2.446)	-0.060 (-2.241)	-0.035 (-1.624)	
AGE	-0.183 (-6.095)	0.021 (0.641)	-0.137 (-4.174)	
NOBAS	0.006 (0.554)	0.017 (1.526)	-0.018 (-1.249)	
SES	0.051 (3.499)	-0.032 (-1.947)	0.069 (5.591)	
INFO	0.029 (1.618)	-0.018 (-0.942)	0.120 (6.656)	
TWOP	-0.052 (-1.032)	-0.050 (-1.018)	0.029 (0.523)	
FL	-0.056 (-1.734)	-0.075 (-2.374)	-0.150 (-5.145)	
TC	-0.034 (-0.517)	-0.042 (-0.645)	0.009 (0.149)	

Perceived Teachers' Expectations Equation (cont.)

	BLACKS		WHITES	
	Reduced Form	Structural Form	Reduced Form	Structural Form
RBS	0.048 (2.287)		0.096 (4.825)	0.043 (2.091)
PTAS	-0.066 (-2.540)		-0.019 (-0.891)	
NHWTV	0.079 (1.453)	-0.102 (-1.811)	0.012 (0.242)	
NHWTV2	-0.141 (-2.091)	0.013 (1.839)	-0.010 (-1.575)	
NTCHSCL	-0.049 (-2.524)	-0.015 (-0.761)	-0.004 (-0.242)	
LSTCHSCL	-0.010 (-0.549)	-0.062 (-3.383)	0.025 (1.463)	
TEST	-0.021 (-0.398)		-0.129 (-2.436)	
PTAAT	0.060 (2.513)		0.043 (1.919)	
NTLKGC	0.231 (11.511)		0.065 (3.415)	
PWPICLY	0.013 (0.325)	0.062 (1.604)	0.005 (0.184)	
MLYBLCK	0.391 (3.914)	0.253 (2.550)	0.039 (0.312)	
MIX	0.383 (3.885)	0.207 (2.250)	0.070 (0.652)	0.015 (1.587)
PWTCHLY	-0.041 (-1.293)	-0.087 (-2.787)	0.072 (2.326)	
TAVR	0.091 (1.793)	0.541 (1.082)	-0.180 (-2.442)	
NTPRPUP	-1.549 (0.402)	4.187 (1.108)	-3.867 (-1.381)	
TPTC	0.335 (2.254)	0.303 (2.103)	0.357 (2.663)	0.268 (2.935)
TASEX	-0.160 (-1.444)	-0.150 (-1.390)	-0.115 (-1.206)	-0.162 (-1.876)
TANYTCH	-0.366 (0.972)	0.056 (0.153)	-0.313 (-1.102)	
TANYTCH2	0.045 (1.062)	-0.018 (-0.434)	0.032 (1.003)	
TPADTN	-0.008 (-0.044)		-0.092 (-0.572)	
NTCHLV	0.064 (2.678)		-0.021 (-1.261)	
AGES	-0.020 (-0.979)		-0.006 (-0.440)	
PROBLEMS	0.009 (0.858)	0.011 (1.021)	0.004 (0.406)	
FACILITS	-0.422 (-3.143)	-0.004 (-0.307)	-0.039 (-2.354)	
PRNMADEG	0.076 (-1.802)		0.041 (1.039)	0.012 (0.344)
MLR^2	0.1041	0.3406	0.1092	0.2312
ALTR^2	0.1041	0.1103	0.1092	0.0985